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THE

MECHANICS' MAGAZINE,

AND

JOURNAL OF ENGINEERING, AGRICULTURAL MACHINERY, MANUFACTURES, AND SHIPBUILDING.

VOL. IX.
(NEW SERIES.)
JANUARY TO JUNE, 1863.

105020-D.
NS, 9

LONDON:
ROBERTSON, BROOMAN, & CO., "MECHANICS' MAGAZINE" AND PATENT OFFICES,
166, FLEET STREET, E.C.

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THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 2, 1863.

RIFLED ARTILLERY.

THE late trials at Shoeburyness have estalished beyond all cavil, that the whole of the expenditure, hitherto, upon Sir William Armstrong's inventions has failed to produce a naval gun superior for practical purposes to the old 68-pounder; and that his ingenuity, aided by an almost unlimited command over the public purse, has succumbed before the practical skill and private means of an individual manufacturer. The results of the experiments were so intelligible, particularly to tax-payers, that no show of scientific knowledge, no flourishing of mathematical formulæ, will be able to cloud the public vision. First, there is one fact which people will interpret in their own way, and which the War Office will find great difficulty to present under any other aspect. After the Russian war, the vote for warlike stores dropped down to £599,191, which we may therefore consider as its normal amount. Since then, that is to say in the last five years, and in addition to salaries and wages £8,141,277 have been voted, or upwards of five millions sterling beyond what would have been spent had the vote remained at the usual amount. What has caused this additional expenditure of five millions, if not the adoption of the Armstrong gun? If it be so, and it is the most natural conclusion, the nation's patience will be sorely tried to find that an outlay so enormous has been of no avail, so far as regards the armaments of our ships of war, and that, even in what concerns the land service, a better gun has been made by the most scientific mechanical engineer of the day, and that, not only without the assistance, but with the ill-favour of the Ordnance authorities. In presence of the crushing superiority of the Whitworth gun, it becomes a question of national importance what course the executive may determine to adopt. To continue now to manufacture Armstrong guns will be about as prudent as to fall back on carronades, or on cross-bolts; for in case of war, and of an enemy's iron-cased frigate, armed with Whitworth's, falling foul of the "Warrior" or the "Black Prince," the latter would have her sides smashed in and her between decks shelled out at a range at which Armstrong's bolts would be as harmless as paper pellets. This was conclusively proved by the late experiments, and it is mortifying in the extreme, after all the official boasting and extravagance that have occurred. Indeed, the history of the introduction of rifled ordnance into the service is not creditable to the enterprise of the authorities.

It is sixteen years since Major Cavalli, of the Sardinian service, and Baron Wahrendorff, of the Swedish service, brought out the rifled breach loading cannon. Four years later these two guns were tried at Shoeburyness, when the practicability and correctness of the principle were shown, although at that early stage there was abundant room for improvement. From the first the Swedish gun was the most successful; its bore was 6·37 in., and therefore nearly resembled our 32-pounder that weighs 56 cwt., and the bore of which is 6·375. The Wahrendorff gun threw a cylindro conoidal shot weighing 64 lbs.; and attained a range of nearly 4,000 yards. With a charge of 10 lbs. it exceeded the range of the 32-pounder by 1,100 yards. At a date anterior to that of the Shoeburyness trials Continental artillerists had satisfied themselves of the value of the Swedish invention, and they did not hesitate to recommend its adoption into the armament of men-of-war. M. Daru, in his report on naval artillery, May 1851, stated—"We think that in the very rare cases—where it will be compulsory to fire at long range at a distant ship, it will be necessary and sufficient to place on the forecastle and quarter deck a few rifled cannon, 30-pounders recently tried in Sweden, and which will complete the armament of men-of-war successfully, and in a manner truly formidable by the accuracy of their aim." Vice-Admiral Laine urged on the French Government the necessity of testing the Wahrendorff gun, and of introducing it into the navy. The armament which he proposed at the Enquête Parliamentaire for a French three-decker was—main deck, twenty-eight 30-pounders and four 8¾ inch shell guns; middle deck, thirty 30-pounders and four 8¾ inch shell guns; lower deck thirty-four 30-pounders; forecastle and quarter deck, twelve 30-pound carronades and four rifled Swedish guns. Nevertheless, both here and in France the question was suffered to fall into abeyance, though Lancaster about this time patented his system of rifling ordnance.

The Russian war made more than ever apparent the desirability of obtaining long range and accuracy of aim. Inkermann proved the rifle musket to be the queen of weapons, for to its efficiency our troops owed, in great measure, their escape from destruction, and the Russians their repulse. The huge expenditure of ammunition, and the little effect produced thereby, again directed attention to rifled ordnance. Lancaster supplied cannon, and, whatever might have been their practice, they failed to remove the prejudice in favour of smooth bores. About this time, also, Lord Paget exhibited a rifled gun at Woolwich, which stripped the lead coating from the shot as it issued forth from the muzzle, and scattered the fragments all round. It was as dangerous to friend as to foe. With the return of peace the question was again shelved, and the authorities appeared to concur in Sir Howard Douglas's opinion that "such guns (rifled ones) cannot enter into the armaments of ships of war, but they may be used with advantage for flanking defences in casemates, or in coast batteries for firing at objects at a great distance."

Meanwhile, the Woolwich authorities were slumbering, the Emperor of the French had remitted the question to the Committee of Artillery for investigation. A hundred and twenty years ago, Robins, the Quaker artillerist, stated that the imparting of spiral motion to shot would produce a complete change in the practice of war. And of that change the Emperor determined to take the first advantage. It has been shown above that the members of the naval commission were strongly in favour of the introduction of rifled ordnance, at a time when Earl Russell, the premier, and Sir F. T. Baring, at the Admiralty, had never given the subject a thought; and nothing, perhaps, is better calculated to show the strength of mind of Napoleon, his command over himself, and how, with the occasion, he can rise far above personal consideration, than this resolve of his. For he had then just completed the introduction of a field-piece of his inventiou—the Napoleon gun, as it was called—into the army. It was a 12-pounder howitzer gun, or an 8-pounder bored up to that calibre, mounted on an 8-pounder carriage, and capable of firing shell, shot, case, and spherical case, which were the only projectiles provided. The gun had been especially devised to carry out the new system of artillery which the Emperor had suggested while President, and which consisted in establishing field batteries of a uniform calibre, in place of batteries of 8-pounder and 12-pounder guns, and the howitzers of two different calibres. He had for years experimented with the gun, and had written in favour of it. When placed in position to carry out his theory, he had nearly 2,000 field-pieces re-cast, with which the army was supplied, so that *amour propre*, and even the policy of not allowing it to appear, he had made a mistake, or had wasted the national resources, would, had he been an ordinary individual, have operated to prevent his allowing a new system of artillery to be introduced under his very nose, and to the complete superseding of his own pet system. Yet, notwithstanding all this, the artillery factory in the Place St. Thomas d'Aquin, at Paris, was set to work to rifle all the mountain batteries consisting of 4-pounders and the old 8-pounders, while new guns were being cast to be rifled. The rifled Napoleon guns were intended to be used for sieges, and the rifled 4-pounders for field batteries. The extreme range was 3,000 metres, and the effective range 1,800. They were rifled with three grooves; those now in use are rifled on the Whitworth system, with the addition of the angles being cut off. What was the result of this innovation the reader does not require to be told. Magenta and Solferino amply recompensed the Emperor for any sacrifice of self-pride he may have made.

The history of the introduction of rifled guns into the French navy is equally instructive. French naval artillerists have for a long time been in favour of as close an approach to uniformity of calibre as possible, and, strangely enough, of the retention of carronades so many years after their expulsion from our service, on the demonstration of their inefficiency during the second American war. They evinced considerable hesitation to follow us in increasing the calibre and weight of ship's guns. In 1812 Napoleon decreed that the armament of a first-rate was to consist of 118 guns, weighing 378 tons. There were four calibres—32 36-pounders, 34 24-pounders, 34 18-pounders, and 18 8-pounders. In 1829 the first step was taken, to approximate to uniformity of calibre, by the issue of a royal *ordonnance*, which fixed the number of a first-rate at 120 guns, weighing 325 tons. They consisted of 66 30-pounders of the first and second class, 50 30-pounder carronades, and 4 18-pounders. In 1837 the shell gun of Paixhans, which had been proved twelve years previously at Brest, was introduced on board men-of-war. A first-rate carried 62 30-pounders, 4 8¾-in. shell guns, 38 6-in. shell guns—making a total of 120 guns, weighing 349 tons. The Government of the Republic, in 1848, simplified the calibre of the armament by fixing it at 16 8¾-in. shell guns and 100 30-pounder guns and howitzers, weighing 345 tons. The year following was marked by important changes. The carronade and 6-in. shell gun were expelled the service, and two new pieces introduced, the 50-pounder and the 30-pounder belonging to a new class (the fourth). The number of guns was fixed at 112, weighing 380 tons, viz., 6 50-pounders, 94 30-pounders, and 6 8¾-in. shell guns. Thus, during twenty years, the number of guns had diminished from 120 to 112, and their weight increased from 325 to 380 tons. The aim of naval artillerists on the other side of the Channel has been to obtain uniformity of [illegible] and guns easily worked, [illegible] range and heavy shot. The 50-pounder was intended to reply to our 68-pounder, as it throws a shot of 55 lb., and has about the same range, but it has not been looked on with favour, nor by any means as a step in advance. The favourite gun was the 30-pounder, because it was capable of firing solid shot or shell, and the latter projectile, with a charge of 8 lb., will penetrate 12 inches of oak at a distance of 1,400 yards. The 30-pounder, with an elevation that is easily obtainable on board a ship, could be relied on to hit an object at 2,200 yards. It required 14 men, and could be fired five times, while the 50-pounder took 16 men, and could only be fired four times in the same period. It is, therefore, not surprising that, when rifled ordnance was to be introduced, the rifling should be applied to the favourite naval gun—the 30-pounder. Accordingly, prior and during the Austrian war, the pieces of this calibre in stock were rifled. They were bored with three shallow broad grooves, having by no means a sharp twist—not much more than a quarter of a turn from muzzle to breech. The shell fired from this gun weighs 57 lb., and ranges 8,000 yards, and it is made after the invention of Mr. Lovell, published in 1844, with three feathers on the circumference, which are faced with zinc where they come against the edges of the rifle grooves. It is this gun—which, at the short range of 130 ft., is effective against French armour plates 12 centimetres thick—that has given rise to the tale about the 90-pounder adopted into the Imperial navy, which appeared in a letter to the editor of the *Times*, and was repeated at Cambridge by Mr. Aston. With respect to the gun which the *Times*' correspondent stated pierced a 4½ in. iron plate at 1,093 yards, so far back as August last year, we confess to be doubtful, for we have heard of at least a dozen inventions which have done as much before trial in the polygon at Vincennes, and after were never heard of. What tends to confirm the doubt is, that, at that very period, the armament of the "Solferino" was fixed at 52 rifled 30-pounders. At the same time we are perfectly aware of two things. The first is, that French artillerists, after ample trials, have come to the conclusion that the Armstrong gun is a mistake. They do not hesitate to speak of it with ridicule as a weapon of war. The second fact is, that Whitworth's system is perfectly well known to the authorities in Paris, and approved of by them; and that they possess mines, especially in the newly annexed districts of Savoy, which affords the best material for the production of homogeneous metal.

Under all the circumstances of the case—the complete failure of the Armstrong gun in penetrating power, as compared with the Whitworth gun—it is no more than what is due to a proper administration of national revenue, and to national security, to suspend rifling guns on the Armstrong system, until the authorities can do what the public did long ago—decide which is the best weapon.

GOVERNMENT ENGINEERS AFLOAT AND ASHORE.

SOME few weeks ago, we took occasion to comment, with some severity, upon the moral disabilities under which engineers in the British navy labour; and we have since had the satisfaction of learning that our remarks were not without effect upon the Board of Admiralty. That eventually those disabilities will be swept away, and a proper amount of respect be accorded by their brother officers to naval engineers, we firmly believe. With those moral grievances, however, the notorious physical disadvantages, which the same valuable class of men have at present to submit to, must disappear, if the service is to be recruited with efficient hands, and maintained with due dignity. The mess-berths of engineer officers of the navy, for example, are, in nine cases out of ten, unfit for human habitation, and the complaints which emanates from those who are so unfortunate as to occupy them are, very justly, both numerous and loud. How can the Admiralty, therefore, who are supposed to be, and who should be, using every effort to obtain competent engineers for the navy, hope to succeed in the task? Clearly, if the existing state of things be continued, they will not succeed; and the post of engineer in the navy, instead of being an object of ambition to educated and talented young men in our factories, will be regarded by them as a mere refuge for the destitute, and to be accordingly shunned. We have hope that so deplorable a consummation will be avoided, and that the worst days of the naval engineer are past.

Whilst advocating the cause of engineers afloat, let us not forget the claims of engineers ashore. In the Government steam factories of this country, there is, as is well known, a numerous body of skilful and highly intelligent engineers. These, too, are, in many instances, exceedingly dissatisfied with the working of the Admiralty rules and regulations which control their movements. As a proof that this dissatisfaction arises from no imaginary causes, it is our purpose to refer to circumstances which have transpired during the past year, in reference to promotions in the Royal Steam Factory, at Woolwich Dockyard.

In April last, a circular memorandum emanated from the Admiralty, and reached the various dockyards of the United Kingdom. It ran thus:—

"As one or more vacancies will probably shortly occur in the junior grade of officers in the dockyards, my Lords deem it desirable that these vacancies should be filled by persons of such age and acquirements that they may be expected, after some years' experience, to become well qualified to serve in the higher grades. This cannot be hoped for if persons of advanced age or low qualifications be selected. With this important object in view, my Lords consider that a somewhat similar course should be adopted in making the selection as obtains in respect of the shipwright officers, and of many others in the civil service, namely, by competitive examination.

"It may be expected that comparatively young men, thus selected, would be stimulated by a prospect of promotion to perform the duties first assigned to them, and to qualify themselves, as far as they may be able, subsequently to perform duties of greater importance.

"You are, therefore, to call on the captains of the Steam Reserves, and the officers of the factories, to report the names of such candidates, under their orders, as they may consider qualified to fill the situation of assistant-inspector of machinery at the factories.

"It being intended to subject the candidates to an examination at the Royal Naval College, at Portsmouth, to ascertain the extent of their mathematical acquirements, this qualification need not weigh with the officers in making their selection. They should take into consideration the mechanical abilities of the candidates, their experience and knowledge of steam machinery, and other practical qualifications, as well as their character, conduct, and general fitness for the office in question, as far as may be known to the officers, from personal knowledge, or can be ascertained from unquestionable testimonials.

"Together with the list of names, the age of each candidate, which must be between 25 and 35 years, where he was brought up, when, and how he was subsequently employed, should be stated; copies also of such testimonials as the officers consider important are to be forwarded, with any remarks on the several candidates which, in the opinion of the officers, ought to be known to their lordships before they make the ultimate selections for appointments.

"By command of their Lordships,
(Signed) "W. G. ROMAINE."

We have thought it desirable to reproduce this document *in extenso*, because it will materially assist the reader in comprehending fully the bearings of the question to which we draw attention. Nothing can be said against competitive examinations, provided they are fairly carried out; and the standard applied to candidates is in accordance with the nature of the duties they are desirous of fulfilling. To bring forward a high educational test in the promotion of officers from one grade to another, and especially among professional men in our dockyards, is, however, a questionable proceeding, and one open to very grave objections. It is evident that its result would be to make mere scholastic and theoretical knowledge take precedence of solid practical experience, which is the qualification most needed.

Their Lordships say, that they are desirous that the appointments referred to should be held by persons of such an age as that they may be expected, after some years' experience, to become well qualified to serve in the higher grades; and that this cannot be hoped for if persons of advanced age, or low qualifications, be selected.

What their Lordships mean by advanced ages is explained in the last paragraph of their circular, namely, beyond 35 years. They thus actually promulgate the absurd dictum that an officer who has served in an inferior position, no matter with what credit and honour, and who has attained the ripe age of 35 years, is unfitted for further advancement! He must then, according to the ruling of "my Lords," stand aside, and allow younger men to pass up the ladder of promotion. It is needless to discuss the mischievous and unjust tendency of such a doctrine. It is so palpably a wrong to faithful servants of the State, that no course of sophistry, as we think, could make it appear to be tinctured with fairness.

In the second paragraph of the circular quoted, the same authorities state that a similar course ought to be adopted to that already in force, with respect to the promotion of shipwright officers, namely, by competitive examination. Had their lordships really framed the regulations, touching engineer officers, on the model of those which govern the shipwrights' department, no reasonable ground for complaint would have existed, but they have done nothing of the kind. Like the Athenians of old, they "understand what is good," but do not practice it.

In the shipwrights' department, it is not only asserted, but made compulsory, that in order to rise to the superior positions of assistant master shipwright, and master shipwright, the candidate must have have filled the subordinate offices of artizan, leading-man, foreman, and inspector, and have held each for a term of three years. Inferior officers are also eligible for promotion until 50 years of age. Where, then, is the comparison between the two branches of the Government service?

In the shipwrights' department, too, the examination required at each successive step of promotion is clearly set forth, and, we believe, in most cases, faithfully adhered to; so that the officers engaged therein have every facility given them for earning advancement. The monstrous injustice of limiting the age of aspirants to 35 years in the one case, and extending it to 50 in the other, cannot but strike every ingenuous observer of the fact. Why, as a rule, engineers, at 35, have much of their business to learn, and are reckoned, out of the Government dockyards, young men.

In considering the enactments and assertions of the April circular, the idea has thrust itself upon us that "my Lords" were influenced in its concoction by the Report of the Committee of 1858-9, on Dockyard Economy.

That committee recommended that, in future, the superior officers of the shipwrights' department be taken, one-third from the rank of foremen, and the other two-thirds from some far off or exalted class. At page 40, and paragraph 359, of their report, the committee in question say, "For the superior officers not made from the rank of foremen, young men of superior standing and education, specially noticed by competitive examination" should be selected, and that "the young men thus entered should then be specially trained for the positions of assistant master shipwright, and assistant surveyors, and for those positions only, in the same manner as young commissioned officers for the army and navy are trained for their positions." The committee further proceed to state as their reason for this absurd dogma, that "It is not good to take young men of a lower position in society, such as sons of working men, and by an examination in which they have been put into competition with none but their own compeers, raise them at once into a position superior to that of their own fathers or families."

The monstrous doctrines thus coolly propounded met a severe rebuke from the late Mr. Abethell, master shipwright, of Portsmouth Dockyard, and assuredly cannot be too warmly denounced by all right-thinking men. It does seem, nevertheless, that the Admiralty is acting upon them in its treatment of Government engineers; for, at a competitive examination which took place lately at the Naval College at Portsmouth, for the purpose of filling the office of assistant to the chief engineer at Woolwich Dockyard, "theory" drove "practice" completely out of the field, and obtained the appointment. The candidates were twelve in number, and comprised the following:—One chief and four junior engineers in the royal navy; four leading men in the steam factories; and three draughtsmen. The questions put to the candidates were, to the extent of three-fourths, purely theoretical. Five hundred marks were considered the maximum of excellence, and at the close of the examination Mr. James Bamister, draughtsman, was found to have obtained 450, and the chief engineer of the navy 45.

After a brief interval, the appointment was conferred on the gentleman who obtained the greatest number of marks. He is now, therefore, an officer at Woolwich.

The successful candidate is known to possess very superior scholastic acquirements, and to be of studious habits. He has, in fact, all the accomplishments fitting him for the post of tutor in an academy, but none for that of assistant engineer of a dockyard. We believe we are right in stating that he never lifted a tool on a steam engine or in the construction of engine gearing, and that he was never present at the trial of a single steam vessel prior to his appointment at Woolwich.

We do not wish to disparage the gentleman who has thus been thrust, by the mischievous working of a board regulation, into a position for which he, of all others, must feel most painfully his unfitness.

To exalt thus ludicrously a gentleman distinguished only for scholastic acquirements, and for being under 35 years of age, at the expense of others who have *proved* their aptitude and acquirements in the great practical school of engineering, and who were thoroughly competent for the post he occupies, is a severe commentary upon the common sense of my Lords. It is this kind of treatment which drives the best men from Government service; and, consequent upon similar anomalies, at least five leading men of the Government Steam Factories have, during the last three years, left the British service altogether, and gone into that of Russia; three or four others have become superintendents of private engineering firms; and it will not be surprising if others follow their examples.

PATENT LAW REFORM.

So much has lately been said on Patent Rights, considered in the abstract, that we will not at present enlarge on this theme. When such names as Adam Smith, John Stuart Mill, Jeremy Bentham, Lord Brougham, Lord Stanley, M'Culloch, and Babbage can be cited in defence of any principle of Political Economy, it would be mere tautology to try our "'prentice hand" in adducing additional evidence. We have selected these names, amongst many others, as it is well known that none of these distinguished men were ever patentees, so that their testimony to the truth must be disinterested. We might also cite Sir David Brewster, Professor Wheatstone, and Baron Liebig, as being in favour of patents. They are, however, themselves patentees, so that we could not give their opinions as uninfluenced by personal considerations.

We believe that monopoly patents were first granted by our Tudor princes, in order to encourage foreign artizans to settle down in England, and thus fill up the devastation caused by the civil wars of the Roses. These monopolies were in opposition to the trade monopolies of the ancient guilds or trade corporations. The royal patents enabled the foreign artizans to exercise their several trades without being obliged to be members of the English guilds. Patents, intended to encourage trade, at last degenerated into the oppressive monopolies that were repealed by James I. The statesmen of that time, while correcting an abuse, saw that the system of patents was a powerful means for encouraging progress and invention. Our patent laws have given an example that has been followed by the Legislatures of all civilized nations.

The history of the steam-engine, of the cotton and iron manufactures, is the history of a succession of patents. The power of England may be said to rely on the genius of invention, fostered for nearly three centuries by the patent laws.

In those halcyon days of some eleven years ago, when the *Times* was better managed than it is now, that paper took a different view of patent right. Before it ignorantly let itself be transmogrified into an Armstrong gun, the the thunders of Printing-house Square were in a very different key. Armstrong guns have an ugly trick of bursting and recoiling on those behind them.

The following is an extract from a leader on Patent Law in the *Times* of 1851. After some remarks in favour of Patent Right, it says:—

"Such being the case as respects the justice, the policy, of this privilege, what, let us next inquire, are those peculiar and formidable difficulties, which are supposed to stand in the way of the legislator, when endeavouring to confer it as a reward upon a meritorious discoverer? We are told that, do what we will, there will be frauds practised on society by pretended discoverers, and upon real discoverers by unscrupulous pirates, and frauds to such an extent as to annihilate all possible advantage from the intended privilege. But, surely as regards pretended discoveries, the ordinary competition of men engaged in business may be safely relied on as an adequate security. If the asserted invention be useless, then is the community not injured in any way by granting a privilege with respect to it. The only loser in this case would be the person who had paid his fee for the evidence of his right—in other words, for his patent. If the supposed invention were merely pretended, and not original, then, as by experience we know, the pretended privilege would be treated as a nullity. This, undoubtedly, under any system, no matter how judiciously framed, would give occasion to litigation. But the possibility of litigation is a necessary incident upon the existence of law; and, if such danger of possible litigation be a sufficient reason for having no patent law, it is a sufficient reason, also, for having no law at all. The law that created rights, would be useless, unless it also gave the means of defending them when attacked; the means are to be found in litigation. The object of the legislator with regard to litigation ought to be, to make it dangerous only to the dishonest, and in the case before us, as in all others, that would be best accomplished by making the law itself unambiguous, and the remedy simple and cheap. The crying evil, however, of our existing system is that it entails upon the unfortunate person, who seeks for the protection of a patent, enormous trouble, vexatious delay, and wanton expense; and if in the discussions upon the details of the proposed measure, attention had been steadily directed to making the acquisition of a patent a matter of little trouble, and small expense, the time of the Legislature would have been more beneficially employed than in wrangling about principles, upon which most men of sense are agreed, or in bandying about imputations of unworthy motives, leading alike to a loss of temper and reputation.

"The obtaining a patent ought to be a matter o course; a small fee ought to be required, together with a specification of the invention; neither the value of a discovery, nor the question of originality ought, in any case, to be mooted upon the taking out of the patent. The real safeguard is not to be found in the vexation of preliminary inquiry, but in the interests of the public. They who are excluded from the enjoyment of the alleged discovery will be sufficiently on the alert to protect themselves, and thereby to shield the public from injustice. The pretended discovery will be invaded, and the useless one neglected. In addition to the fee exacted upon taking out a patent, an annual rent might be fairly required during the continuance of the privilege. By thus spreading the whole sum paid by the patent over the period for which it is in force, the tax levied upon the discoverer, in return for the protection and exclusive enjoyment given by society, would be in proportion to the value of this privilege. Those patents that were not successful would not be continued, while those that were profitable would be annually renewed. If the original fee were small, this rent would be cheerfully paid, and a law thus simple and just would further alike the interests of the public and the inventor."

Most of the above remarks of the *Times* are as pertinent in 1863 as in 1851. This is especially the case with the paragraph alluding to the discussion of general principles instead of practical details. It appears to us that there is one question upon which reform or non-reform almost entirely depends, and that is the question of "what constitutes NOVELTY?" What constitutes a publication? According to English law (Hindmarch on Patents, 1846, p. 108), "The importation of a foreign book into this country, containing a description of an invention, would not be sufficient to defeat a subsequent patent for it, unless the work was actually sold, and published to the public here, from the date of the patent. If, however, a single copy of a foreign work is deposited in the British Museum library, or in any other place to which the public can resort for information, any subsequent patent is invalidated." See also Baron Heurteloup's case, Webster's Reports, vol. 1, p. 553.

As a comment on this, we will quote the following:—Mr. Bennet Woodcroft was asked before the 1851 committee on the patent laws, "Have you prepared a complete series of the inventions connected with the steam-engine?—Answer: I commenced to write an analytical history of the steam-engine, and, to my great surprise, I found in 'Hero of Alexandria,' the whole of the elements of the steam-engine. I found every valve, the slide-valve, the clack-valve, and the spindle-valve, all in 'Hero of Alexandria;' and I found a metallic piston, working in a metallic cylinder."

According to paragraph 25 of the 15th and 16th Victoria, a patent, if granted for an invention patented in a foreign country, is invalid after the expiration of the foreign patent. It would thus appear that any old foreign patent is also invalid in England.

We will now try to ascertain what constitutes *novelty* in foreign countries. According to article 6 of the old law of 1839, an invention can be patented in the United States within six months after being patented abroad. The American commissioners also seem to require *absolute* novelty.

The law of patents at present existing in France is that of 1844. By articles 30 and 31 of that law, absolute novelty is required. According to article 31, "Ne sera pas reputée nouvelle toute découverte invention ou application qui, en France *ou a l'etranger*, et antérieurement à la date du depôt de la demande, aura reçu une publicité suffisante pour pouvoir être exécutée."

The different German states composing the Zollverein have a special law for each state. There is, however, an existing general convention between all these states. The following is a translation of Art. 1 of this convention:—"The States must only grant patents for really new and peculiar (eigenthümliche) things. A patent must not be granted for things that were in any way known before within the states of the Zollverein. In particular, a patent must be refused for anything that has been described *in a published work, inland or foreign*, written in German or any other language; supposing the thing to be described or illustrated in such wise, that it might be carried out by any expert. Each Government of the Zollverein is its own judge as to novelty or speciality of the invention to be patented."

Mr. Wedding, one of the Prussian patent examining commission, appeared as a witness before the committee of 1851. He stated, in answer to the question, "what proportion of applications are refused at present (1851)? There may be 400 or 500 applications made during the year; perhaps there may not be more than 70 or 80 patents granted." (We alluded some time ago to the fact of Monsieur Giffard having been refused a Prussian paten)t. This patent is, probably, worth £100,000 in England alone.) He was also asked: "What would be the law in the event of its being discovered, after a patent had been granted, that the invention or the process had been in use previously? Answer: Of course the party loses his patent right. In the *guarantee* (!) of the patent there are always some lines to say—as far as we are acquainted with it, it is new. We may get, bye-and-bye, the knowledge that this may not be a new invention; it may be described elsewhere, or some of our own countrymen may have *tried* to do it, or it may be executed already; therefore, the members are obliged to say—as much as we know, we regard this as new. No comment is needed on this!

The Austrian law requires a previous examination of a patent; but this examination is merely nominal; it gives no guarantee, and absolute novelty is required to make a patent valid. A Belgian patent is given without any examination, and at the risk and peril of the inventor. According to No. 5, article 24, law of 1854, a patent is invalid if it be described in a printed work previously to the granting of the patent. The Spanish, Italian, and Portuguese patent laws are similar to those of Belgium, all of them being framed somewhat similarly to the French law. The patent laws of Holland, Russia, and Sweden, are similar to those of Austria and Prussia. The patents have to pass an examination, but the passing of this examination does not save them from any subsequent attack on the score of want of novelty.

The above extracts will give the reader some idea how the patent laws of the different civilized countries bear *upon each other*, in respect to novelty. We are, probably, within the estimate when we assert, that there are 200,000 patents in the world fully described, and illustrated. Some of these are, no doubt, repetitions, from the same thing being patented in different countries. There are, however, many patents containing a number of different inventions. Such are some of the patents taken out under the old law in England. These are technically termed "omnibus patents," from the fact of there being as many different inventions wedged in, as a 'bus conductor can crowd into an omnibus on a rainy day. Even Mr. Woodcroft's indices are ineffectual in sifting them. As far as this is possible, however, the 50,000 English specifications are accessible enough. It has been impossible for Mr. Woodcroft to give proper headings to all the inventions under the old law. In the excellently managed patent office in Southampton-buildings, all the official foreign publications have been collected. The indices only of the French patents are complete. Only some of the French patents have been published. These select few were those judged at the time to be the best. Some of the most important have been omitted, thus affording a practical commentary on the principle of selection as applied to the "utility" of inventions. The American Commissioners' reports are curiously arranged, according to the fancy of each successive new Commissioner. Only the "claims" are given. There are also some meagre official accounts of the German, Italian, and Belgian patents. We will suppose that a determined patentee has waded through the 200,000 patents! This is not sufficient, however. An Alexandrian manuscript may turn up, as it did in the case we have have cited of Mr. Woodcroft's. Further intercourse with China or Japan may lead to a deeper appreciation of the fact that there is nothing new under the sun. The records of the British Museum, modern and ancient, in foreign or dead languages, have still to be examined before a patent can be obtained that will stand the test of *absolute* novelty.

For instance, we may even some day discover, by means of a recondite antiquarian process, that Robin Hood gave the original idea of a flat-fronted projectile. The main idea of the flat-fronted shot has lately been found to be embodied in an old English war-arrow. We may yet discover that Robin Hood invented this kind of arrow for piercing the breast-plates of the men-at-arms of the *late* sheriff of Nottingham!

If this difficulty of ascertaining the novelty be great in England, how much more so must it be in other countries! As we said before, there are probably more than 200,000 patents in the world. The public libraries are positively gorged with old works on machinery, full of the most ingenious arrangements. Would it be possible, we will not say for an individual, but for even a regiment of accomplished *savants*, to wade through such a mass of material? This test of absolute novelty is the plague-spot of the modern system of patents. It is this which renders property in invention so precarious, and often so ruinous. Very few patents can be received as really valid until they have passed the ordeal by fire of a court of law. In fact, there are now such a number of patents, that we are almost in the position the late Mr. Brunel wished for. He used to say: make patents cheap, and they will become so numerous that each patent will destroy the other.

The progress of a good invention has several stages, like Shakespeare's seven ages of man:—1, A man of observation or of genius sees a want or gap in current technical life, and he dovetails his idea into it. The invention is thus conceived, and it is then drawn out, say, on paper. 2, It is put into some demonstrable shape. 3, On being shown in a state of "bantling" to others, it is sneered at, unless the inventor be of an already-established reputation. It is made a butt whereon others can exercise their skill in finding objections. 4, It is at last elaborated by the parent, and on its being ocularly demonstrated that the thing is good, it is received as a "*fait accompli.*" 5, Like satellites round the sun, or, rather, like parasitic insects on an animal, swarms of evasions, copies, *soi-disant* improvements, and inland and foreign infringements are immediately hatched. 6, "Last stage of all that ends this strange eventful history," the invention is discovered to be old. Perhaps some elderly gentleman, in some remote part of the kingdom, proves on black and white, that he has done the thing before. *We* often look upon such assertions as a confession of folly. Some old patent is perhaps dug up, or some parchment is exhumed out of the depths of the British Museum, and the invention is shown to have been known in the time of our great-grandmothers. 7, The invention being now old, it must therefore die. Death-warrants are at once applied for in our courts of law. If the patentee has a long purse, as well as a long head, he is able to protect his invention. If not, it drops into the great maw of the public. An examination of the reports of the patent trials we publish in our columns, will show that three-quarters of the oppositions to successful inventions are based on questions of priority. The question of novelty always offers a formidable weapon to plagiarism and evasion. How would it be possible for *any* commission, however powerful in numbers and intelligence, to decide upon the absolute novelty of any patent? No doubt this crying evil is often met, at present, by the good sense of the judge and jury trying a case. As is well known, the bias of juries is generally for the patentee, and against pirates; not so, however, as between patentee and public. We will refer to a well-known instance.

According to the minutes of evidence before the 1851 Committee on the patent law, Sir David Brewster was asked: "Supposing a scientific man has an idea, and he does not think that it would be worth while to go to the expense of a patent to protect him in that idea, is not there the motive of fame, which would induce most scientific men to give to the public that idea?

The reply was: It depends very much upon the man. There are many instances of things being kept secret, and not published. In the case of the achromatic telescope, it was invented by a country gentleman of the name of Hall, who did not choose to take out a patent, but put the telescope into his drawer; Mr. Dolland got a patent for it afterwards. The instrument was found, after the death of Mr. Hall, to be the real achromatic telescope. It was decided that Mr. Dolland was not vitiated by the previous discovery of Mr. Hall, who had not made it public."

The Patent Law Commissioners now sitting have lately asked the Birmingham Chamber of Commerce, the following question amongst the others we gave in our last number:—"*Is it your opinion that there ought to be a preliminary investigation of a more searching character than that which at present takes place?*" To this we would reply, Yes.

The preliminary investigations should be very searching, but they should only go back fifteen or twenty years. There should be a law of limitation. "*All inventions and discoveries should be accepted as new, that had ceased to be worked in England for the last twenty years.*" This appears to be the only way to render a board of examiners at all practicable. Sir David Brewster was questioned before the Committee of 1851, as to how he proposed that the Board of Commissioners, the appointment of which he recommended, should be able to ascertain the novelty of an invention. He answered: "The Commissioners must make themselves acquainted with the progress of science and art during a certain period; it would not be necessary to go very far back. It would be very absurd to prevent any man getting a patent, because such a thing had been known, or even registered, fifty years before. I would hold the property of all ideas to be extinct after a certain time to be named, and after that time the board should make it their business to be acquainted with all those inventions and processes which have been since published and secured by patent."

Capitalists grumble at having to buy up intellect. There are hundreds of old patented mechanical arrangements, perfectly visionary twenty or thirty years ago, that could now be carried out with our present engineering facilities. Who could afford to put them into a practical shape, and to have them pirated the next moment? There can be no stronger argument in favour of patents than is afforded by this fact, a matter of continual occurrence, as every one knows, who has been engaged in practical life. The recent descision in the celebrated case "Betts *v.* Menzies," in the House of Lords, may be cited as carrying out this view.

Besides the merit which consists in first conceiving a new thing, then testing it by the light of science, and putting it into a practical shape, there are other merits and difficulties about inventing, no less great than the preceding ones.

These latter consist in fully seeing the value of any invention, in its application to the existing state of things. A sound appreciation of any new discovery or application requires a powerful and practised intellect, before success has given the stamp of current coin to the precious metal. Take the history of the steam engine. It is full of instances illustrating the difficulty of sound appreciation of any new discovery.

What would Watt have done without a Boulton? We all know what Smeaton once thought of the steam-engine. Take again the special developments of steam. What was the fate of Trevethick with his locomotive? The reception of George Stephenson by the quondam committee of the House of Commons is passing into a proverb. What were the fates of Symington in England, and Fulton in America?

To come to more recent times The steam fire-engines, now getting so largely into use, were invented and practically used by Mr. John Braithwaite, more than 20 years ago.

The patent of Nasmyth's steam hammer, by which he is said to have made £80,000, was invalid all the time he was working it. An older specification than his has been recently dug up. If this specification had unfortunately been discovered, during the time Mr. Nasmyth was working out his patent, should this gentleman have been deprived of the just reward due to his ingenuity? We might multiply these instances, even while confining ourselves to the steam engine.

Our proposition of defining as novel any idea that has not been used for the last 20 years, will no doubt be met with the following objections. It will be said that it is:—1, In contradiction to the principle of giving a patent as a reward for merit. 2, That giving a patent for an old invention would be a robbery of the public.

To the first objection we would answer that a patent is *not* granted as a reward for merit. The best proof of this consists in the fact that a patent is refused for a new principle, the thing the most difficult to discover. According to Mr. Webster, patents rest upon two principles, 1, That of just remuneration to the individual inventor; and, 2, That of promoting the public interest. The principle as recognized by the common law of this realm, was this:—He who shall introduce a new trade into the realm, or an invention tending to the furtherance of a trade, shall have a monopoly patent for a reasonable time, till the public shall learn the same. The means of instructing the public, under the common law, was by requiring the patentee to take apprentices. That was not a very practical mode, and it has been entirely superseded by the modern rule of the specification. It is required of the party, as a consideration for the monopoly he enjoys, that he shall give the public a distinct account of his invention in the nature of a specification, so that they may have possession and advantage of it when the patent expires.

To the second objection we would answer: Suppose that the public do not accept or neglect the teaching of an inventor for, say, 20, 30, or 50 years? Such an invention is practically lost to the public, to the mass, who require tangible, ocular practical evidence, before they will receive anything in science as a truth. An idea consigned to the Limbo of bygone patents is like a seed or root buried with an Egyptian mummy. It requires to be dug up, to be planted and watered by an intelligent hand, before it will take life and flourish. Is it to be expected that any man will go to the trouble, the expense, the risk, of thus giving new life to a forgotten scheme without expecting some compensation for his exertions?

We do not suppose that the opinions we have expressed will meet with favour in all quarters. It would be very difficult for any opinion to do this. Everybody has some special "patent medicine" for infusing new life into our petrified patent law. However that may be, the spark of truth is often elicited from the shock of discussion.

We hope that the Patent Commission now sitting will take plenty of evidence as to the working of the patent laws of foreign countries. A sound examination and comparison of results of the different systems ought to afford a good basis for legislation. It would be like an examination into the results of a series of experiments instituted for the elucidation of some question of science.

II.

INTERNATIONAL EXHIBITION. JURORS' REPORT.

Class X., Section A.—Civil Engineering and Building Contrivances.

II.—Harbours and Docks.

(*Continued from page 414.*)

The new naval graving docks of Castigneau, at the arsenal of Toulon, as designed by, and constructed under the direction of, M. Noel, inspector-general of bridges and roads, director of maritime constructions at Toulon, are remarkable for their extent, and the great natural difficulties which attended their construction, all of which were overcome in a very masterly manner by the engineer and his assistants, for which they are entitled to considerable credit. The soil upon which these docks are built is of a soft alluvial nature, and, there being no rise of tide, it was necessary to fix the floors of these docks at the full depth required to float the largest vessels of war; the soil, moreover, was so porous, that a single coffer-dam in the sea in front of where the docks were to be constructed would not have sufficed to have kept the works dry while they were proceeding; it therefore became necessary to enclose the whole space with a double row of piles, filling in the space between them with concrete, as fast as the earth was dredged out; this concrete subsequently serving the additional purpose of forming an important part of the side walls of the intended docks. The great mass of earth from within the centre space, enclosed by the double row of piles before mentioned, was then removed by excavating down to the proper depth, and the bottom of the dock was founded upon a bed of masonry and concrete, upon piles; the whole of the bottom and sides being then faced with masonry throughout; thus three substantial and effective graving docks for the largest vessels of war were completed in a novel and successful manner. The dimensions of all three docks are 102¾ metres, 121 metres, and 166½ metres in length, with a general width of 22 metres, and a depth of water on the cill of 9½ metres. To M. Noel, inspector-general of bridges and roads, a medal has been awarded for these very extensive works, methodically executed by simple and certain means, comprehending even the smallest details.

The graving dock at the dockyard at Rochefort is an important work; it is 134 metres in length by 22½ metres wide, with a depth of water of upwards of 8½ metres at high water; thus a vessel of 125 metres long by 21 metres wide can be accommodated. The foundations were of a difficult nature, but they were very satisfactorily accomplished, and the general work is very successful. For this work, executed under circumstances of difficulty, a collective honourable mention has been awarded to M. Garnier, engineer-in-chief of bridges and roads, to M. Angiboust, engineer of bridges and roads, and to M. Charvin, resident engineer.

In connection with this subject must be mentioned the ingenious mode of blasting the submerged rock of La Rose, at the entrance of the Port of Brest. This rock, which was of compact gneiss, with veins of quartz, was entirely removed by repeated explosions of charges of 100 to 120 lbs. of gunpowder, in stone jars, which were placed at high water, by divers, upon the parts of the rock to be shattered. These were fired by Bickford's fuses, enveloped in gutta-percha tubes. The masses of rock thus shattered were removed at low water. By this means, 20,000 cubic metres of rock were removed at depths varying from 7 to 15 metres below the surface of the water, at a cost of about 35 francs per metre. The work was very satisfactorily accomplished under the direction of M. Dehargne, engineer-in-chief of bridges and roads, by M. Verrier, engineer of bridges and roads, to whom a collective honourable mention has been awarded for this successful blasting of a submarine dock without bore-holes.

The coffer-dam for the construction of the dry dock, at the arsenal of L'Orient is nearly on the same system as that employed for the foundation of the quay at the port of St. Nazaire; by means of a series of hollow square masses of masonry, construdted and sunk independently of each other, and then united and filled in solid with rubble-work and hydraulic mortar. For this good application of an ingenious system, applicable in peculiar situations, collective honourable mention has been awarded to M. Harduin, engineer-in-chief, and M. Le Bouedec, engineer of bridges and roads. to whose skill and attention the successful result is due.

To the New South Wales Government has been awarded a medal for the great utility of the Fitzroy Government Dock; and to Mr. Hunt, also of New South Wales, a medal for the public benefit arising from the dock constructed by him.

Before leaving the subject, the floating docks of Sunderland, designed by, and constructed under the direction of, Mr. John Murray, C.E., must be adverted to. The general plan of these docks is a good example of giving a double entrance to a port, affording excellent dock accommodation in the position required, and combined with powerful scouring sluices, for keeping the entrances open; all these most essential objects in the design and construction of a good port are well combined at Sunderland, and a medal has been awarded to Mr. John Murray (United Kingdom, 344), for the merit of the design and the execution of the work.

The application of the hydraulic press for the purpose of raising great weights has long been known and adopted in numerous instances, and latterly very extensively by the late Mr. Robert Stephenson, for raising the large tubular girders composing the Britannia and Conway bridges; a similar idea has been conceived by Mr. Edwin Clark, C.E., and applied in a very ingenious manner for raising floating pontoons, which are made to answer the purposes of dry docks for constructing, examining, or repairing vessels. The operation is very simple. A space of water is enclosed, sufficient for the required pontoon, or floating dock, around which are firmly fixed a number of hollow iron columns, in each of which is a hydraulic press and piston, having chains attached to them; these chains are attached at the other end to transverse wrought-iron girders at the bottom of the inclosed water space; the wrought-iron pontoon, which is to carry the vessel, is then floated between the columns, and sunk on to the girders by admitting water into its compartments until it rests upon the bottom of the inclosed water space; the vessel intended to be repaired is then floated over the pontoon, and is placed accurately above it by means of guides; the girders and pontoon, with the vessel upon it, are then raised by the hydraulic presses, worked by a steam engine and pumps, which act upon the pistons and the chains attached to them, to the cross girders, and as the pontoon rises with the vessel upon it, the water runs freely out of the compartments of the pontoon, and, when the whole is clear, the valves are screwed down from the inside, and the pontoon and vessel are floated away into a basin, and another pontoon is placed in readiness for another similar operation, which generally occupies, for a very large ship, about forty-five minutes. Thus one hydraulic apparatus, with its necessary upright columns, cradle, and basin, or dock space, will answer the purpose of as many dry docks as there are pontoons; and when a vessel has been repaired, the supporting pontoon is again floated over the transverse girders, the valves are opened, and the pontoon sinks gradually, thus leaving the vessel afloat and ready to be taken away. This ingenious adaptation of the hydraulic press is calculated to be very extensively useful in many localities, and to Mr. Edwin Clark, E.C. (United Kingdom, 2,255) a medal has been awarded, for the novelty and general utility of the application.

A large wrought-iron floating dock has been designed, and is being constructed for the Spanish Government by Messrs. G. Rennie and Sons. It is 350 ft. long, 105 ft. wide, and 37½ ft. high, and it will draw, when a vessel of the largest class is in it, about 10 ft. This dock is constructed nearly upon the same principle as the old Dutch Caramel Floating Docks, but is much more complete. It is hollow, is divided into compartments, and is emptied with pumps, worked by a steam-engine placed on the floating dock, so that either by admitting, or by pumping out the water, it can be lowered or raised as may be required, and it can thus be rendered available for any class of vessel. To Messrs. G. Rennie and Sons has been awarded a medal by the Jury of Class XII. for the completeness of the arrangements and the good workmanship of this important construction.

Floating docks upon this as well as upon Clark's system are no doubt very valuable, but it may be a question whether they are likely to supersede the slip system, or that of drawing the vessels out of the water, which can be made equally valuable in certain localities. It is true that the latter system requires that the lower end of the slip should be carried down to the greatest depth, at which a light ship of the largest class can be brought to the lower end of the slip; this cannot be taken at less than sixteen to twenty feet, and to effect this in seas where there is no tide must be attended with considerable expense; and laden vessels cannot, as in Rennie's and Clark's systems, be drawn up, examined, and lowered again within a few hours. Anything by which the old system of heaving down vessels of the ordinary class can be avoided merits attention, as that process is always attended with expense, inconvenience, risk, cost, and delay. The re-introduction of floating docks, on improved principles, has also induced attention to Morton's patent slip, which is now again being brought forward with considerable improvements. All these systems are valuable and useful, and can be brought into the public service where the fixed dock system is considered too expensive, or where the localities are not calculated for such extensive and weighty structures.

III.—Moveable Weirs.

Moveable weirs, or dams for penning up water in rivers, during summer and dry seasons, may be said to be a modern invention, chiefly practised in France, although they somewhat resemble the ancient rude flushing weirs adopted in Great Britain for rendering the shallow parts of rivers navigable during dry seasons. M. Poirée, inspector-general of bridges and roads, has, with great skill, introduced this valuable system, which is the origin of all the improvements since adopted; and in various rivers in France these weirs are applied with complete success; they are either self-acting, or can be lowered, or removed, with the greatest facility, so that the quantity of water in a river can be regulated to the greatest nicety, either for navigation, irrigation, or domestic purposes, whilst every facility is afforded for the discharge of floods. This system may be applied with advantage to many of the rivers and streams in Great Britain.

At the arrage of La Chainette, on the river Yonne, near Auxerre, it has been well applied, and for it, to M. Poirée, inspector-general of bridges and roads, a medal has been awarded for the application of numerous improvements, and to M. Cambuzat, engineer-in-chief of bridges and roads, and M. Marini, resident-engineer, collective honourable mention for the good arrangements and construction of these works.

For the barrages, or weirs, with panel sluices, executed on the upper Seine, a new mode of closing the navigable passes, and of raising the level of the water by ingenious and well-conceived arrangements, insuring a certain and rapid action, as demonstrated at the barrage of Conflans, a medal has been awarded to M. Chanoine, engineer-in-chief of bridges and roads.

And for the new system of moveable panel sluices for the side-cuts of moveable weirs, for the ingenious and simple arrangements and construction, whereby the operation of raising, or of lowering the sluices is rendered almost instantaneous and self-acting, being performed by the action of the water as directed by the raising or the lowering of two paddles worked by one man, a medal has been awarded to M. Louiche-Desfontaines, engineer-in-chief of bridges and roads, as the inventor of this improved system, and to M. Cölin, honourable mention for the excellence of the execution of the model, which exhibits so perfectly the construction and the mode of working. The self-regulating sluice invented by M. Chaubart must also be mentioned for its ingenuity, and for its applicability in many localities.

With this part of the subject must be mentioned the ingenious system devised for carrying the mountain torrent of the Libron on a level across the Canal du Midi. This torrent, generally dry, is subject to sudden flushes from storms, which bring down masses of *debris*, which would fill up the bed of the canal. It became, therefore, necessary to carry the torrent freely across the canal, which was accomplished by having alternative divergent channels, each of which on both sides had sliding troughs, which could be pushed across to form canals for the torrent when requisite, and be removed for the passage of boats, or when the torrent was dry; the waters of the torrent being directed and governed by stop-gates. The details of this simple contrivance were most ingeniously devised and successfully executed by M. Magues, engineer-in-chief of bridges and roads, and M. Simonneau, resident engineer, to whom collective honourable mention has been awarded for this work.

IV.—Compensating Reservoirs, etc.

With regard to the fourth division—the compensating reservoirs for supplying rivers and streams during summer and dry seasons. This is a most important and valuable system, and it has now become an absolute necessity, as, in consequence of the present superior system of land drainage, a greater proportion of the rain-water which falls upon the land is discharged into the rivers, and is carried off almost immediately after it falls, so that in summer and in dry seasons the lands frequently suffer for want of moisture; the navigation is impeded, and the supply of water for irrigation and for domestic purposes is diminished. Moreover, as sewage matter is now generally discharged direct into the nearest water-courses, the small quantity of water in them in times of drought becomes polluted to such an extent that it is unfit for use, whilst the malaria arising from it is liable to produce disease. The great object, therefore, is to obtain a thorough command of water, so that the land may be properly drained, the sewage be carried off effectually, and that there may be at all times an ample supply of good fresh water for navigation, irrigation, and domestic purposes. A system of compensating reservoirs, established in the most convenient places, along the line of, or adjoining the valleys, through which rivers pass, so that the desired quantity of water may be stored in them during the periods of rainfall, and be discharged again by means of proper sluices, into the rivers and other channels, where required during the summer and dry seasons, is evidently the only proper plan to obviate the serious evils above mentioned, and to combine all the desiderta of complete drainage, sewage, navigation, irrigation, and domestic water supply. This system was largely adopted by the ancients in the valley of the Euphrates, India, and elsewhere, and it contributed largely to the wealth and prosperity of those countries wherein it was practised. It redounds greatly to the credit of the French Government and their engineers that this system has been introduced into France with such complete success in many places. It is excellently exemplified by models of the compensating reservoirs of Les Settons, for the service of the river Yonne, for which useful and well-executed work collective honourable mention has been awarded to M. Rozat de Mandres, engineer-in-chief of bridges and roads, who designed, and to MM. Olry de Labry and Marini, resident engineers, who executed the works. Also honourable mention to M. Veron Duverger, engineer-in-chief of bridges and roads, and to M. Sciama, resident engineer of the Reservoir of Montaubry, for the service of the Canal due Centre, in Burgundy, for the excellence of the design and the satisfactory execution of the works.

The introduction of this system into Great Britain, has long been advocated by English engineers, who have devoted their attention to the subject, and it cannot be much longer delayed, as works of this kind are now imperatively demanded, both in a sanitary and economical point of view.

The irrigation canal of Carpentras, in the department of Vaucluse, deserves notice as a most useful and successful work, carefully designed and executed by MM Perrier and Gendarme de Bevotte, engineers-in-chief of bridges and roads, and M. Conte, resident engineer, to whom a collective medal has been awarded by the Jury of Class IX.

V.—SEWERAGE.

In connection with this subject must be mentioned the improved systems of sewerage now being introduced in London and in Paris. They are entitled to much consideration, and demand a more lengthened notice than is consistent with the limits of this report.

The system of sewerage of Paris has hitherto differed essentially from that of London in still retaining for the most part cesspools beneath the court-yards of the houses: the more copious use of water has, however, necessitated a change, and the municipality is proceeding to provide for the new order of things by the construction of sewers beneath the streets, and combining with them collecting reservoirs, and a general distribution of water, comprising an ingenious self-acting method of cleansing the sewers, whilst introducing a more comprehensive and general system of carrying off the water. This combination is well exhibited by a plan of the sewers of Paris, and a model in section of the sewer of the Boulevard Sebastopol, with a plan of the water service of Paris, and a model in section of the reservoir of Passy. This latter work merits careful study, as does also the collection of apparatus used tn the distribution of water throughout the city. The map of this distribution conveys very interesting information; and the model of the great artesian well of Passy, executed by M. Kind, under the direction of MM. Alphand, engineer-in-chief, and Darcel, engineer of bridges and roads, merits every eulogium.

These exhibited great knowledge of the subjects, careful study of the means of meeting the wants, and of carrying out the works gradually, without undue interference with the working of the present system; and for this and the general intelligence exhibited in the design, a collective medal has been awarded to M. Belgrund, engineer-in-chief of bridges and roads, and to his assistants in the execution of these important works.

There were also exhibited, in the French department, several other collections of maps, plans, and models of the system of sewerage adopted in Paris, many of them possessing great interest. The map and atlas of the Catchweter sewers, or, "Egouts Collecteurs," are full of interest, as showing how early that system was recognized and adopted, and the carefully designsd progressive steps taken toward establishing one uniform system. The details are most interesting, and the works reflect infinite credit upon M. Michal, inspector-general of bridges and roads, upon whom devolves the general direction, and upon M. Belgrand, engineer in-chief of bridges and roads, who has charge of the sewerage, having under him MM. Rozat de Mandres and Vallée, engineers of bridges and roads, who have the actual superintandence of the works.

The great collecting sewer of Asnières was constructed under these auspices by M. Delaperche, engineer-in-chief of bridghs and roads.

The sewer of the new Boulevard Sebastopol previously mentioned was more immediately directed by M. Rousselle, engineer of bridges and roads.

A very interesting map of the distribution of water within Paris gave all the details of the supplies, the number of fountains, &c., and of the dimensions and length of the mains, as drawn up under the auspices of M. Michael and M. Belgrand.

Two very interesting and well-executed albums of maps and plans showed all the public squares, gardens, and promenades of Paris, including the Bois de Vincennes and the Bois de Boulogne, where so much ornamental gardening had been done so effectually under the immediate direction of the present Emperor of France. These works, which merit all praise, have been executed by M. Alphand, engineer-in-chief of bridges and roads. MM. Grégoire, Foulard, and Darcel, engineers of bridges and roads; M. Davioud, architect; and M. Barillet-Deschamps, head gardener, acting under the direction of M. Michal, inspector-general of bridges and roads.

The history of the numerous attempts to improve the system of sewerage of London is so well known that it is not necessary to do more than allude to the great works now in progress on both sides of the Thames. The published reports give the details of all the arguments, investigations, calculations, and plans of Mr. Morewood in 1845, Mr. F. Forster in 1851, Mr. R. Stephenson and Sir W. Cubitt in 1854, Mr. J. Simpson, Captain Galton, and Mr. T. E. Blackwell, in 1857, and Messrs. G. P. Bidder, T. Hawksley, and J. W. Bazalgette, in 1859; whence has resulted the comprehensive scheme of works now in course of construction under the direction of Mr. J. W. Bazalgette, C.E., engineer to the Metropolitan Board of Works, to whom an award of a medal would have been recommended had it been compatible with the rules laid down by the Royal Commissioners, which prohibit any award to a member of a jury.

A complete set of plans and documents descriptive of these extensive works was exhibited (United Kingdom, 2,369), and the members of the jury were enabled to judge of their importance by an inspection of the works themselves in their fullest extent.

(To be continued.)

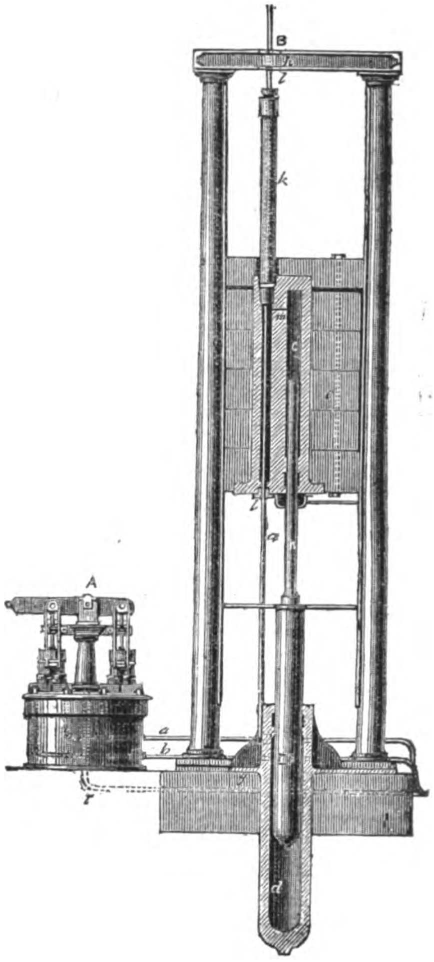
SAMUELSON'S IMPROVEMENTS IN THE WORKING OF HYDROSTATIC PRESSES.

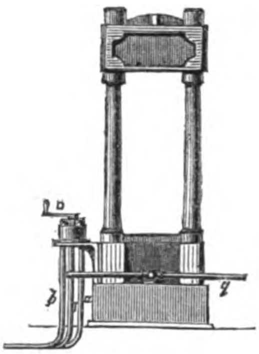
THIS invention seems to be an application of the idea of the accumulator (used by Sir William Armstrong for his water cranes) to hydraulic presses. It is patented by Mr. Alexander Samuelson, whose well-known firm at Hull exhibited a connected series of oil-pressing and oil-cake machinery, in the western annex of the International Exhibition. It relates to a peculiar arrangement of accumulating apparatus to be used in combination with hydrostatic presses for crushing fatty substances, and consists essentially in the adaptation to such presses of an accumulator so arranged that one weight produces two distinct pressures, one considerably greater (by preference about nine times greater) than the other. This is effected in the following manner:—There is a lower cylinder containing oil, water, or other liquid; in this cylinder a ram is fitted in the usual manner. Above this ram, and forming a continuation of it, is an upper ram about one-third the diameter of the lower one; this smaller ram is inserted into an inverted cylinder, also containing oil, water, or other liquid, and which cylinder is imbedded in, and forms part of the weight or load. There is no communication between the two cylinders, each being charged by its own pump or pumps through proper pipes; these pipes also communicating with the stop boxes attached to the presses. A stop box may be fitted to each press, or one stop box may communicate with and actuate several presses. Each stop box is fitted with three ordinary cone valves, namely, one communicating with the low-pressure cylinder of the accumulator, one with the high pressure, and a third to discharge the presses. The spindles of these valves have rather coarse-pitched threads upon them working through the packing glands as nuts, and above these threads, on the tops of the spindles, are cams actuated so as to open and shut the valves by a central cam and handle, and so arranged, that by one revolution of this central cam all the valves are successively opened and shut, as required, in the operation of oil expressing.

The engraving represents a partial sectional elevation of the improved accumulator, showing its connection with the working pumps and with a series of presses. In the engraving only one is shown.

A represents the working pumps; B is the improved accumulator; C, a hydrostatic press; and D, a peculiar form of stop box and mechanism for working the valves, hereinafter fully described.

The pumps may be of the usual construction, but Mr. Samuelson prefers to employ the arrangement for which letters patent were granted to him in 1862, (No. 203). They communicate direct by means of the high and low pressure pipes *a* and *b*, with a peculiar stop box. A vertical branch from the high pressure pipe *a*, which is supplied from the small pumps, leads to the small cylinder *c* of the accumulator, whilst the low-pressure pipe *b* (supplied from the large pumps) communicates by a short lateral horizontal branch with the lower and larger cylinder *d* of the accumulator; *e* is a heavy weight or series of weights, inside of which is fitted the small inverted cylinder *c*; it is guided in its ascent or descent by the vertical guides *f*, *f*, fixed on a strong bed plate *g*, and braced together at the top by the cross beam *h*. The high-pressure pipe *a* passes through a stuffing box *i* in the bottom of one side of the casting in which the small cylinder is formed, so as to allow of the rise and fall of the weight, with its contained cylinder *c*, along the pipe *a*, which passes through the casting before referred to, and through a vertical tube or cylinder *k*, secured to the upper end of the casting a packing gland *l*, forming a liquid-tight joint at the upper end of the tube. One or more small apertures are made in the side of the pipe *a*, through which, and through the small





passage *m* in the casting, the oil or other liquid employed is forced into the small inverted cylinder *c*, so as to act upon the small ram *n* working inside it. This ram forms a continuation of the larger ram *o* working inside the larger cylinder *d*, which may be cast in one piece with the bed plate *g*. It will thus be seen that the cylinders *c* and *d* of the accumulator have no connection with each other, being supplied from the small and large pumps respectively.

D is the body of the stop box, into the bottom of which are made four vertical passages, namely, one central passage in connection with the press pipe, and three outer passages in connection respectively with the high-pressure pipe *a*, low-pressure pipe *b*, and waste pipe *r*. These three outer passages are respectively closed by the valve spindles, and all communicate by radial passages with the central or press pipe. A screw thread is formed on the upper end of each valve spindle, and works through the packing gland as a nut, so that by partially rotating each spindle it will be raised or lowered, thereby opening or closing the valve accordingly. The cams are severally fitted on to their respective valve spindles, and are operated upon successively so as to open the valves by a wiper formed on the boss of the horizontal lever handle turning on a centre. A stud projecting down from the under side of the lever handle, and pressed forward by a spring, serves to reverse the motion of the valve spindles, and close the valves as the handle is rotated. The object of the spring is to force the stud over the points of the cams, and thereby ensure the effectual closing of the valves.

Proceedings of Societies.

INSTITUTION OF ENGINEERS IN SCOTLAND.

First Meeting of Session, 29th Oct., 1862.

Results of an Experimental Inquiry into the Comparative Tensile Strength and other Properties of various kinds of Wrought Iron and Steel.

BY MR. DAVID KIRKALDY.

(*Continued from page* 418.)

In the discussion which followed—

Mr. Walter Macfarlane said it was well known to all practical workers in steel and iron, that if they attempted to temper some kinds of steel articles in water they cracked; but that if they did the same thing in oil there was not the same danger of doing so. He did not know whether Mr. Kirkaldy had given, or could now give, an explanation of the cause of the increased strength of steel when tempered in oil, as compared with that tempered in water? He would like to know whether the fibre altered, or what tended to produce the result.

Dr. Macquorn Rankine remarked, that Mr. Kirkaldy disavowed in his book any attempt to explain the changes which took place in steel when plunged into water or into oil.

Mr. Macfarlane said he thought there was an absolute necessity for their getting at the cause of that important result.

Mr. Kirkaldy, in answer to the president, had nothing further to say upon the point.

Mr. D. More said that Mr. Kirkaldy invited "special attention to the practical use that may be made of the new mode of comparison introduced by him, viz.: the *breaking strain per square inch of the* fractured *area of the specimen, instead of the breaking strain per square inch of the* original *area.*" That seemed to be the principal point hinged upon, as it was given in *italics*. Now, he did not think it was even the breaking strain of the *fractured* area that must be considered, for after the iron was broken it drew out a little further. This sort of posterior action was shown in some experiments made by Dr. Rankine and himself in regard to iron and also brick. They found, in crushing the brick, that it withstood a considerable force, and afterwards crumbled away with a less force, thus showing that the breakage had really taken place before the brick had commenced to crumble away. In experimenting with an iron bar, it was observed that the iron drew out and became narrower at one part (as he showed by a sketch on the board) until the strength of the material was overcome. Then, immediately on the iron beginning to break, it drew out before it was finally completely separated, so that the fracture took place when the bar was a little bigger than it finally became. He thought that the truth lay between the two areas—the original and the fractured area.

Mr. Kirkaldy said he had given the stretched area also in his tables, so that parties could judge of it for themselves. The three areas were given—the original, the stretched, and the fractured areas.

Mr. W. M. Neilson remarked that Mr. Kirkaldy's book was a mass of *data* from which to deduce results. He thought it was a very excellent thing that Mr. Kirkaldy had confined himself to giving facts, which would cause his book to be much more relied upon. He believed that Mr. Kirkaldy wished to lay his facts before the Institution for discussion, and that he would not be displeased, although they pulled them about as they liked. Regarding the effects of frost upon iron, upon which point he had never himself been quite clear, it appeared that frost did not effect the strength in a direct strain; but he had always had an idea, that perhaps not the drawing strain, but the breaking strain, was very much affected by frost. They all knew the fear they had of using chains in frosty weather. Now, he supposed that the strength of the chain links was very much diminished by the frost, and that the links broke not so much by direct tension as by a breaking strain.

Mr. Kirkaldy said his experiments on the influence of frost were all made with specimens taken from one bar. He regretted that the weather changed before he could carry out his intention of repeating these experiments with bars of various qualities. As the bar experimented upon happened to be of very good quality, perhaps they ought not to draw general conclusions from its behaviour.

Mr. W. Simons said that in the operations attending upon the placing of a thousand-ton ship on a ship-dock, during one frosty night he had seen three rods 3½ in. in diameter, broken, so that they had to stop and put fires to all the rods and joints, and after that none of the rods broke. In the International Exhibition, he had observed a very good specimen of Swedish iron, which some of the other members might also have seen, which was all crumpled like a hat, it being the bow of a steamer after collision. He did not believe that any Scotch iron would have stood such a test. He was of opinion that the result of Mr. Kirkaldy's investigations would be, that the present system of shipbuilding would be found to be entirely erroneous, and that for the future iron would be used in shipbuilding with its longtitudinal fibre placed in the direction of the most constant strain, a principle which had hitherto been ignored in marine construction.

Mr. B. Connor said that some very interesting experiments, which had not been published, had been recently made by Messrs. Naylor and Vickers, at Sheffield, with a view of testing steel, so as to ascertain the best suited for railway axles and tyres. They had found that the material best suited for axles was the worst for standing great tension. They found that steel, which could bear only 35 tons of tension, was the best for journals. They tried steel with 15 cwt. falling from 1 ft. up to 36 ft. The tensional strength of the steel was then increased so as to stand up to 69 or 70 tons, but it broke with the weight falling one-third of the space, and with less than one-half of the weight; and so that that which stood the greatest tension broke with the least concussion. He thought that between the highest and the lowest qualities of steel there was only a difference of one-fourth per cent. of carbon.

Mr. Kirkaldy thought that these experiments supplied strong reasons for taking the stretched and fractured areas into account.

Mr. B. Connor did not think the steel with the greatest amount of carbon, that broke almost short off, would show nearly so great a difference between the fractured and the original areas as the soft steel.

Dr. Macquorn Rankine concurred in what Mr. W. M. Neilson had said as to the very valuable collection of facts, most of them entirely new, which Mr. Kirkaldy had given in his book. It was a storehouse, from which they could all draw materials, and form their own conclusions upon them. Mr. Kirkaldy had very fairly described those facts, and it was the better that he had not set up any hypothesis upon them. One of the particular things which he (Dr. Rankine) remarked was, that the experiments of Mr. Kirkaldy seemed to point to the conclusion, that a process which many supposed to take place, namely, a change from the fibrous to the crystalline structure, had no real existence; and that the same piece of iron would show a crystalline or fibrous appearance accordingly as it was broken by a stroke or a strain. He came to the same conclusion himself nineteen years ago by experimenting on the fracture of railway axles, which when fitted up seemed to have been quite strong enough. He collected the broken-off journals of such axles; but he was sorry that he could not now produce them, as no means had been taken to prevent the ends getting rusty. But he had made full-sized drawings, coloured from nature, of the more remarkable of them, which he presented to the Institution of Civil Engineers, along with a paper, an abstract of which was published; but the drawings were not published, and remained at that Institution, where they could be seen by any one. He still, however, possessed the originals of those drawings; and if it would be agreeable to this Institution to see them, he would produce them at a future meeting. Of course they were not so satisfactory as the original specimens, or as Mr. Kirkaldy's; but unfortunately the originals had been spoiled by rust. He got the journals of axles that had run two or three years, and had then broken off spontaneously, and almost every one of these showed a fibrous fracture, with here and there a crystalline spot. There was invariably a crack which had eaten in from the shoulder of the journal, and which was perfectly imperceptible until after the fracture took place. The crack seemed to have gone on until it had reduced the original diameter of the journal to about one-half, and then the axle snapped; but it always presented a fibrous fracture, whilst if the same journals were broken off with the blow of a hammer, they presented crystalline or granular fractures. Accordingly, he had ever since thought it probable that a change from fibrous to crystalline, as supposed, was an erroneous hypothesis; and he believed that many other persons had come to the same opinion, and he was glad that Mr. Kirkaldy's experiments corroborated it. An important point in those experiments was the calling attention to the comparison between the fractured area and the load that caused the piece to give way. Every one knew before, that bars of iron would draw out, especially if soft, before giving way; but never before Mr. Kirkaldy had any one accurately measured the final area to compare that with the load. He thought that there was a great deal in the principle Mr. Kirkaldy laid down as to testing the quality of iron, by the comparison of the breaking strain with the fractured area; but he would not go so far as Mr. Kirkaldy and say that it was the most accurate test, although he had no doubt it was better than comparing the original area with the breaking load. The experiments of Mr. Kirkaldy had substantiated results that had been anticipated by theory. For example, it was a result of theory that the form of the longitudinal section influenced the breaking load per inch of area. Experimentalists, however, had not taken that into consideration before. Experiments were made upon the tenacity of bars that were for a long distance of a uniform diameter, but there had been experiments made with bars shaped so as to have an increasing diameter on both sides of the middle part (as he pointed out on the board), and the result was a great apparent increase of strength. It had been perfectly well understood by writers on the theory of elasticity, that the shape referred to must give apparent increased strength to the narrow portion of the area, as the wider parts on each side resisted the tendency to draw out, which was not the case with the parallel bar. Experimentalists, however, had not taken this into account until Mr. Kirkaldy took it up and arrived at the results detailed in his book. Mr. Kirkalday showed that the resistance of steel rivets to shearing was about a quarter less than the tenacity of the steel. That, also, was anticipated by theory. There was one very important point upon which Mr. Kirkaldy made some remarks, namely, as to the factor of safety—the ratio in which the breaking load ought to exceed the working load. Mr. Kirkaldy considered that the working load per square inch of the original area of the piece should be a certain percentage of the breaking load per square inch of the contracted area at the instant of being broken. He (Dr. Rankine) concurred in Mr. More's opinion, that the truth lay between the extreme views. He thought it would be going rather too far to make the working load per square inch a certain fraction of the breaking load per square inch of the fractured area. He might call attention to experiments made on the strength of steel by Prof. Tresca, of the French Government Corps of Engineers. They were made upon bars of steel cut out of boiler plates, and they showed the gradual elongation of the bar with the gradual increase of the load. The results were represented by a curve (of a kind sketched on the board by Dr. Rankine), the abscisses of which represented the loads, whilst the ordinates represented the elongations due to the loads. It was found that as the load was increased, the elongation increased at a uniform rate, until it reached a certain point, when there occurred a great increase in the rate of elongation, which was not quite sudden, though nearly so; and there resulted a curve, the early part of which proceeded in a nearly uniform direction, and which merged by a quick bend into a portion proceeding in a different direction corresponding to the more rapid elongation. Now, he thought the point where the change in the curve of elongation occurred was that at which the strength of the material had been overcome. It was very probable that the drawing out, which was so conspicuous in Mr. Kirkaldy's experiments, began at that point, and that the greatly-increased curve of elongation showed that the breaking had begun, and that the bar would break if the same load was simply put on it several times, without being increased, as was seen in Mr. Fairbairn's experiments. The experiments of this class was very interesting, taken in connection with Mr. Kirkaldy's experiments. He thought, then, that the best test of the quality of the material was the strain at which the sudden change of the curve of elongation began; or, if that supposition of his was right, the point at which the drawing out of the fibres commenced. If they could only make experiments so precisely as to measure the area of the bar at the instant of change, and compare it with the load, and take the corresponding strain per square inch, they would get at the true strength of the material; it would give a result between that of the old method and that of Mr. Kirkaldy's method. But although it was very desirable to obtain such experiments, yet there were difficulties in the way of performing them upon the immense number of materials that Mr. Kirkaldy had experimented upon. The Institution could not be too grateful to him for his labours, for he had collected a mass of facts which were of the highest value in a scientific and practical point of view.

Mr. James Russell would like to notice one proposition in Mr. Kirkaldy's treatise as to the appearances presented by the bar fractured when the fracture was made suddenly or slowly. It appeared that iron broken very slowly had a fibrous appearance, whilst that snapped off was crystalline. They all knew that if they wished to judge of the quality of iron in a rough way, they would break it probably over the anvil and look at the fibre. They found that bars broken in the same way presented very different appearances. They also found that some of the bars broken by Mr. Kirkaldy were half fibrous and half crystalline. Now, if the appearance of the fracture was no sure test of the quality of the iron, then they were put in a very awkward position as to judging of any iron that came under their notice to apply to various purposes. He dared say that it would agree with all their experience that iron had been judged by the appearance of the break. It was also known that a chain working on a crane might have sustained great loads for a long time, and yet break with a very much lower strain, and the broken link have a very crystalline appearance. A case came under his own notice where the top chain of a Derrick crane bore a heavy strain, and yet broke with a third of the weight that had been on it previously, and the link presented a very crystalline appearance. He hoped other members of the Institution would make a few observations on this important matter.

The President asked what was the state of the weather when the rod broke?

Mr. James Russell dared say they had seen them break in all kinds of weather; but uniformly when the link of a chain broke with a comparatively light load, it was more crystalline in appearance than other links that stood the test. For instance, they might take one bar and give it a blow, bending it only, whilst another would, with the like blow, snap at once like cast-iron. They were in the habit of saying that the one that bended was fibrous, and the one that snapped was crystalline.

Mr. Faulds could not look on a crane chain being broken with a third of its previous load as a criterion by which they could judge of the strength of iron, for a careless man by giving it a jerk would bring it down. But with reference to breaking iron, so as to appear fibrous or crystalline, any smith could take a bit of the best iron and break it, either crystalline or fibrous, as he choose.

Mr. W. Macfarlane would call attention to another phase of the question besides the quality of the material. They must not lose sight of the fact that some firms turned out better work than others, although using the same materials, and that induced him to call their attention to the annealing of iron. The strength of iron was very much reduced by the breaking of the skin, so that the strength of a finished shaft was less than when it left the forger's hands. In articles of great value, when the safety of many lives rested upon the security thereof, it occurred to him that it would be well if wrought-iron were annealed. He would like to know whether any extensive producers of such articles had made experiments on the annealing of iron work; and, further, what would be the expense if turned shafts were annealed or tempered in oil. His impression was that the same results must follow as with cast-steel, and that the strength of the material would be very much increased by the annealing or by the tempering process of oil—these two modes of treatment being quite different in their results.

Mr. Faulds had thought that the breaking of the skin weakened a bar of iron; but he understood Mr. Kirkaldy to say that a turned bar would stand as much strain as an unturned one.

Mr. R. B. Bell wished to call to Mr. Macfarlane's attention the fact that Mr. Kirkaldy had drawn up these statistics from actual and accurately-arranged experiments, so that what he had put forward were facts, not mere opinions or prejudices; and he would like to krow if what Mr. Macfarlane stated was merely his opinion, or if he had made actual experiments with bars of equal sizes to ascertain this fact?

Mr. W. Macfarlane said it was from his own practical euperience, but without making any special experiments to test the correctness of his deductions. His belief was that if the skin of an inch-bar of cast-iron were broken, it was weakened very much.

Mr. W. M. Neilson suggested that instead of "practical experience," perhaps Mr. Macfarlane should have said "practical prejudice."

Dr. Macquorn Rankine said he thought that no one would question the greater strength of cast-iron with the skin than without it; but as regarded wrought-iron, he did not believe that there had been any precise experiments until Mr. Kirkaldy made his. There was one matter about which there was no doubt; that if they had to turn a piece of wrought-iron they ought to interrupt, as little as possible, the continuity of the fibres; this was to be insured by forging it as nearly to the required shape as possible, so as to have little cross-cutting of the fibres. He had verified that doctrine at the time when he experimented with the axles, nineteen years ago.

The President said that the skin of all malleable-iron was broken in bringing it into use, as in tyres, axles, &c.

Dr. Macquorn Rankine said that if they took two journals of the same diameter that had been turned alike, but which had been hammered down to different forms, although they were of the same dimensions, yet on account of the continuity of the fibres in the one not being interrupted, it was stronger than the other in which the fibres were cut by the turning process.

Mr. Macfarlane said he hoped they would excuse him pressing upon them the importance of annealing important forgings. His own opinion was that it would materially strengthen them.

Mr. W. M. Neilson remarked that he thought what Mr. Macfarlane insisted on was, in other words, to make the iron more homogeneous.

Dr. Macquorn Rankine said there was one other fact of considerable importance that Mr. Kirkaldy brought out, which had been anticipated by theoretical writers, that the stretching of the metal tended to diminish its density.

Mr. R. B. Bell drew attention to the fact, which Mr. Kirkaldy had made known, that galvanizing did not hurt the strength of iron in large sections; and he could add, that it did not do so in small ones, as had been proved in testing galvanized and ungalvanized wire ropes.

Mr. Macfarlane would like to know what process of galvanizing was referred to, as the one was a mechanical combination with the iron, while the other was chemical.

Mr. Kirkaldy said it was the chemical process.

Mr. W. Simons believed that, with reference to galvanized iron ropes, the result had been quite the opposite of that stated by Mr. Bell.

Dr. Macquorn Rankine said he had made experiments on that subject, and the result he came to was that the ungalvanized iron was, perhaps, a shade stronger, but the galvanized was more extensible. The result was, that what the galvanized rope wanted in tenacity, it more than made up by being more extensible, and it was, therefore, better able to resist a shock. The difference in tenacity, however, was so small, that it might have arisen from errors in the experiments. One peculiarity he had observed in galvanized wire was, that when a certain pull was put upon it, much of the elongation that took place was permanent. Perhaps that arose feom the compression of the layer of zinc. The permanent elongation did not increase by repeated applications of the load, provided the load was within the limits of safety.

Mr. D. More asked if Mr. Macfarlane thought that if they annealed forgings before they were finished it would add to their strength, or must they be annealed after being finished?

Mr. Macfarlane replied that they should be annealed when they came out of the forger's hands, but tempered after they were finished.

Mr. D. More asked—Would there not be some danger of the shaft getting warped?

Dr. Macquorn Rankine asked if Mr. Macfarlane intended them to be put into cold oil?

Mr. Macfarlane answered in the affirmative.

Mr. Faulds said that there would be a danger of twisting a shaft if it were annealed after being finished.

Mr. Macfarlane said that the strength would be increased, but admitted the danger of twisting.

The President then proposed the thanks of the Institution to Mr. Kirkaldy for bringing so valuable a series of experiments before them. He thought they would all agree with him, that the discussion should be adjourned, in order that members who were absent might have an opportunity of giving their views on that important subject, and also in order that they might have an opportunity of inspecting the drawings which Dr. Rankine had so handsomely offered to lay before them.

The vote of thanks was passed, and the discussion adjourned.

STRENGTH OF TIMBER.

The *Scottish Farmer*, in giving the following rule, founded on the experiments of Muschenbroeck, states that specimens experimented upon were in a sound state. Muschenbroeck used the Amsterdam pound, 100 of which is equivalent to 109 avoirdupois:—Locust *(Robinia pseudo Acacia)*, 20,100; beech, oak, 17,300; alder, 13,900; elm, 13,200; mulberry, willow, 12,500; ash, 12,000; plum, 11,800: elder, 10,000; fir, 8,330; walnut, 8,130; pitch pine, 7,650; cypress, 6,000; poplar, 5,500; cedar, 4,880. So much, however, depends on the part of the tree from which the specimen is taken, and also on the nature of the soil, the age of the tree, and other matters, that great variations will be found in different specimens, and one-third of the above breaking weight could only be used in practice, except the line under which the timber has to be stretched is short, when half may be safely trusted to. When the specimen is near the heart or bark it is weakest, and midway between these, strongest; the parts near the root are also stronger than those near the division of the tree into branches; a dry soil produces harder, heavier, finer-grained, and stronger wood than a moist one, and the colour of it is yellower than that of timber grown in a damp soil, arising from its pores being filled with a gummy matter. Sussex, the south-west of Kent, the north-west of Hampshire, produce good oaks, for instance. In seasoning, some will retain the same weight nearly; as common Riga tops, Baltimore pitch pine butts, Halifax and Canada spruce butts, teak tops and butts, Cape yellow wood and stink wood butts, Irish bog oak, Surinam letter wood, and South American cedar. Some will become heavier, from losing more in dimension than weight, as best Riga tops, North American pitch pine tops, and Canada spruce fir tops; most others become lighter. No species hardly ever shortens in seasoning, but they generally do in breadth, from about $\frac{1}{8}$ to $\frac{3}{8}$ of an inch to a foot. Teak, stink wood, Irish bog oak, letter wood, and South American cedar, are exceptions to this. Oak loses one-third of its weight in seasoning, particularly if grown in a moist soil, and the specific gravity varies from 1,090 to 700 in some which he tried. Du Hamel states that the density of trees grown in the same climate, but on different soils, varies from 7 to 5, and the strength, both before and after seasoning, from 4 to 5. When they had not passed their prime, the density of the butt is to that of the top as 4 to 3, and that of the centre to that of the circumference as 7 to 5; the reverse of this occurs when the tree is past its prime. These variations will serve to account for the difference between experimenters. A wood called iron wood, or red wood (supposed to be *Erythroxylon areolatum*), exhibited amongst Jamaica productions at the Paris Exhibition, was found to bear the prodigious weight of nearly 7 tons, the specimen being only 2 in. square and 12 in. long. The strongest wood in the Exhibition of 1862 was in the New South Wales Court, under the name of grey iron bark (*Eucalyptus sp.*), 5 ton 4 cwt. being its breaking weight. Even of that the proper botanic name is uncertain.

THE RICHARDS INDICATOR.

THIS indicator has been aptly termed the "*stethescope*" of the steam-engine. Properly applied, and its deductions rightly followed, it can, no doubt, often cure the iron "*patient*" of *consumption* of fuel. The following is a description, extracted from the specification of an improved form of indicator, invented by C. Richards, of Hartford, Connecticut, and patented in this country by C. T. Porter, 100, Fleet-street:—

The form of steam-engine indicator in most general use is that commonly known as the "McNaught Indicator," in which the piston and its guiding rod have the same range of motion as the pencil, but as the piston and rod are necessarily made quite heavy, and their range of motion extensive, in order to produce delineations on a sufficiently large scale, the momentum of these parts is so great, and tremulousness of the spring is so considerable, as to render the instrument unserviceable for application to engines having rapid movements. While, therefore, it is desirable to reduce the momentum of the parts which are moved by the varying pressures of the steam, as well as the length and consequent tremulousness of the spring, it is also desirable that the pencil or marking point should move in a straight line, in order that its delineations, which should be on a large scale, may readily be measured with accuracy, and in order also that the paper on which the delineations are made may be clamped in the usual manner around a cylindrical drum, to which the requisite movements can be readily given by the customary means. To furnish an instrument possessing the above-mentioned desirable features is the object of this invention, and to this end it consists in the employment of a lever, or its equivalent, so connected with the pencil and the piston as to give to the pencil a range of motion greater than that of the piston in combination with a system of levers or an equivalent therefore, so arranged as to cause the pencil's point to travel in a straight line, substantially in the manner hereinafter clearly set forth.

Figure 2 is a plan of the same. Figure 1 is a side elevation of the instrument. Similar letters of reference denote the same parts in the two figures.

In the accompanying engravings A is a cylindrical case containing a small steam cylinder B, in which moves a piston, the movements of which are regulated by a spiral spring inside. These parts are constructed and arranged in a manner similar to, but are much shorter than the corresponding parts of, an ordinary McNaught indicator, making delineations on the the same scale. To the outside of the case A is secured a ferule E, an arm from which supports a cylindrical paper holder F, which in construction and arrangement is similar to the paper-holding drum of a McNaught indicator, and it receives the proper reciprocating movements in the same manner. Around the upper part of the case A is a ferule G, to which are attached two arms H and J, one of which, J, supports the fulcrum pin K of a light lever L, the extreme end of which lever is jointed to the end of a lever or link M, the opposite end of which is jointed to the extremity of a delicate lever or radius bar N, the fulcrum pin O of which is suported by the arm H. To the lever L, at a point distant from its fulcrum K, about one-fourth of the length of the lever, the rod P of the piston C is connected by means of a forked link Q, which is jointed a knuckle R to the upper end of the rod P. In the centre of the link M is a holder for the pencil S, which receives from the piston C, through the lever L, a range of perpendicular motion about four times greater than that of the said piston, and the levers L and N are so proportioned, and their fulcrums are so adjusted, that the marking point of the pencil S is caused to move in a straight line in the same manner that the "parallel motion" of a steam engine causes the end of the piston rod to move in a straight line. The movements of the lever are indicated in Figure 1. The application and mode of using this improved indicator are essentially the same as of McNaught's instrument, and need no description.

THE RICHARDS INDICATOR.

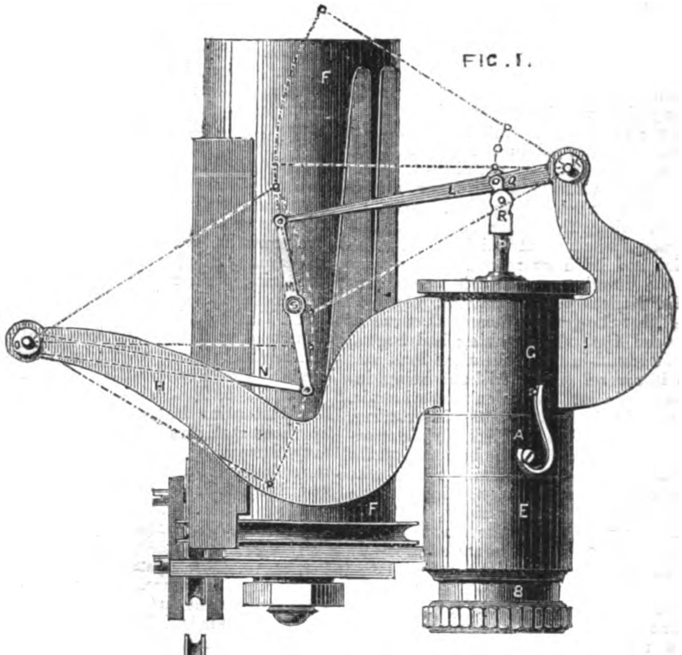


FIG. 1.

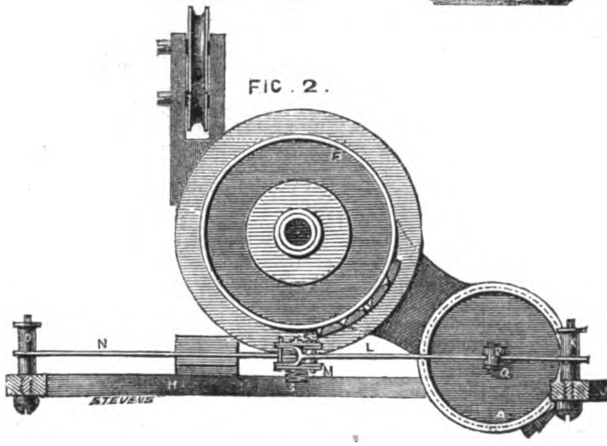


FIG. 2.

CAPTAIN BOLTON'S IMPROVEMENTS IN TELEGRAPHING FOR NAVAL AND MILITARY PURPOSES.

LAST week the *Times*, in its "Naval and Military Intelligence," gave an animated description of experiments recently made at Portsmouth to test Captain Bolton's system of telegraphing for naval, military, and other purposes. It is said the experiments were quite successful. Underneath will be found a detailed description of the invention, which relates to a means of transmitting intelligence or despatches in broad daylight by means of signals produced by flashes of light of long or short duration, or both combined. This object is effected by the employment of an intensely powerful light, consisting either of the electric light, the lime, or other light, which is to be alternately obscured or eclipsed and displayed so as to produce visible flashes of light of long or short duration, and in any desired order of succession so as to produce the required signals. In combination with this light, lenses, reflectors, or other well-known optical arrangements, are used, in order to prevent the dispersion of the light, and to more effectually concentrate or project it in the form of a pencil of rays upon the distant station or observer. The signals are produced by temporarily obscuring the light by means of shutters (or other suitable contrivances) for longer or shorter periods, and in any pre-arranged order that may be desired. In conjunction with this apparatus for transmitting the light, the signals are received in a darkened chamber, or other convenient appliance, through a lens or on a reflector, whereby they are concentrated on a field, from which all unnecessary rays of light are excluded. By these means the eye of the observer, being relieved from the redundant or extraneous light, will be enabled more readily to perceive and note the signals that are made at the distant stations. The light whereby the signals are produced may be obscured or displayed; that is, the shutters or equivalent contrivance may be raised and lowered, by causing electro-magnets to act on armatures connected with the shutters. These electro-magnets may be put in action from a distant station, by causing a current of electricity to pass through the coils of the electro-magnets in any of the well known manners for working electro-magnetic apparatus.

Fig. 1 is a plan of the apparatus with the cover removed, and Fig. 2 a section of the same. A is the oxyhydrogen gas jet, which is supplied with the two gases through pipes or tubes; B is the

CAPTAIN BOLTON'S IMPROVEMENTS IN TELEGRAPHING FOR NAVAL AND MILITARY PURPOSES.

FIG. 2.

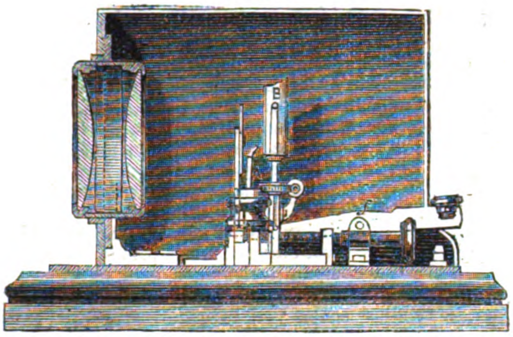


FIG. 1.

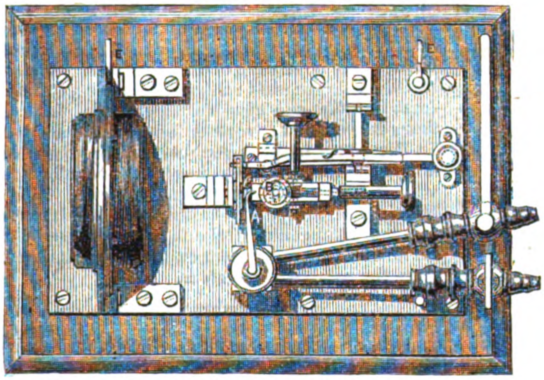


FIG. 4.

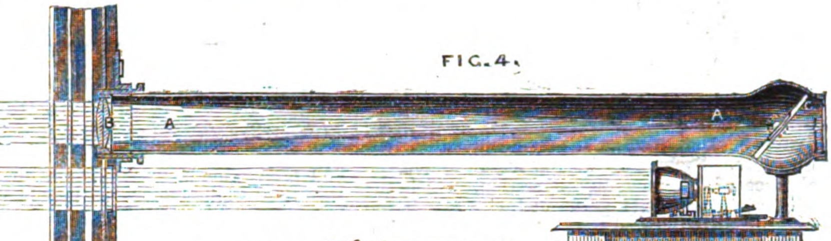


FIG. 3.

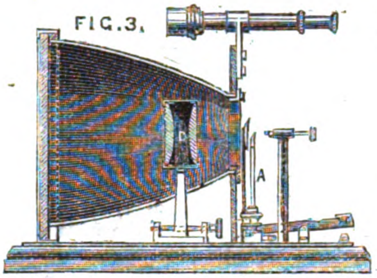


FIG. 6.

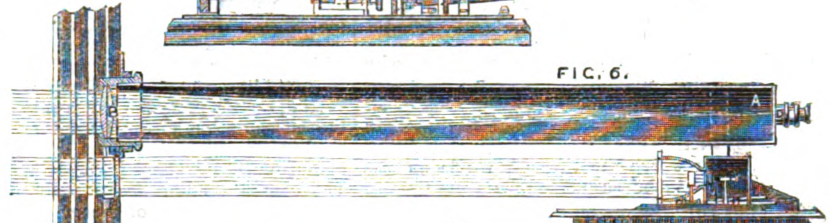
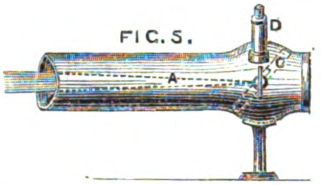


FIG. 5.



lime cylinder mounted on the vertical stud pin, which may be caused to revolve by means of a worm, which is worked by hand, or by means of clockwork if desired. The vertical stud pin is held in a spring clamp, fitted with a screw adjustment, by which the distance of the lime from the gas jet can be regulated and adjusted at pleasure with nicety. The lime cylinder may be placed horizontally instead of vertically, as shown at Fig. 3.

The shutter consists of a circular piece of platinum or other metal slightly concave, attached to a cranked arm, which is mounted upon a stud axle, carried by a bracket screwed to the bed plate of the apparatus, and immediately behind the gas jet. The lower end of this lever arm has a projection at right angles to the arm, in which is a horizontal slot. In this slot works one end of a key lever, which turns upon a fulcrum pin carried in brackets screwed to the bed plate. The opposite end of this lever carries a finger button, by which the operator depresses the lever, and immediately the arm carrying the shutter will be removed from before the light. A spring is caused to bear up against the under side of the lever, and returns it to its former position, when the pressure of the finger of the operator is removed. By thus depressing the lever, for a longer or shorter time, the rays of light will be thrown in flashes of longer or shorter duration on to, and through the arrangement of lenses, shown in section at Fig. 2, which is simply a combination of two plano-convex lenses mounted in the vertical plate, and capable of adjustment laterally. It will, therefore, be obvious, that any other arrangement of lenses may be used that will effectually concentrate and project the rays of light in parallel lines. In order to adjust the position of the instrument, so that the signals shall be projected on the distant station, two telescopic lenses, or eye-pieces E are attached to one side of the instrument, or a telescope may be mounted thereon.

A modification of the above described apparatus is shown at Fig. 3, which is a longitudinal vertical section of an apparatus in which the lenses D are surrounded by or placed within a parabolic reflector, for more effectually preventing the dispersion of the rays of light, and for concentrating the rays on the centre of the lenses. The circular platinum shutter may be divided into two parts, and slightly overlap at the joint. Each part can be rivetted on vertical arms screwed to the bed plate of the apparatus. Any number of lime lights and lenses, combined and arranged around a common centre, may be used.

Fig. 4 shows a sectional view of an arrangement of apparatus for receiving the signals from distant stations. Fig. 5 is a detached side elevation of part of the apparatus. The rays of light from the distant apparatus are received in a darkened chamber or tube A, through the lens B, adapted to the outer end of the tube A, and by which lens the rays are condensed and thrown upon a field C. This field may be made of a flat disc, painted black, but having a white spot or centre, and can be set at the proper angle by adjusting screws. An eye piece or magnifier D is mounted on the end of the darkened chamber or tube, as seen in Fig 5, for the purpose of minutely examining the disc. The tube or darkened chamber A is supported on a table, or in any other convenient manner, so that by means of the magnifier or eye-piece D, the most delicate pencil of rays will be rendered visible, and may be easily read off by the observer.

An instrument for the transmission of signals in answer, similar in construction to that just described, is represented at Fig. 6. It will be seen that the rays of light are received in a darkened chamber A; but, instead of being thrown on to a disc C, they are conducted direct to the eye-piece D. This is, perhaps, a more convenient form of apparatus, but if desired, a reflector may be substituted for the disc C, and the signals may be read off without the aid of a microscope. The signalling or telegraphing apparatus above described may either be placed at fixed points, or it may be made portable for military purposes. It may also be used on board ship for signalling or communicating intelligence to stations on shore or with the several ships of a fleet or squadron; and as every facility exists for making long or short flashes of light, signals or intelligence can be communicated with great rapidity by means of such long or short flashes, or both combined, according to any pre-arranged code of signals.

EXPERIMENTS AT SHOEBURYNESS.

On Tuesday last, some target trials took place at Shoeburyness. The iron shield of Capt. Inglis, R.E., which was tried on that day, was intended to test the value of thick iron plates as embrasures for casemated batteries of masonry. The shield is 11 ft. in length by 8 ft. in height, with an embrasure in the centre. It is composed of slates of iron of different thicknesses, varying from 4 to 8 in., the thickest plates being next the embrasure, the armour plates and backing, which is composed of thinner plates, being a body of about 15 in. of iron, which, with the diagonal supporting frame, cannot equal less than 18 in. of solid iron, or 720 lb. per foot area. The fastenings are chiefly through bolts, with elastic washers. Whatever may be the objections to such fastenings for lighter armour plates, they certainly stood the test well on Tuesday, while the rivet heads, which at previous experiments have stood best, were inferior in this instance. The guns used were the regular service 68-pounder, a 110-pounder Armstrong, and a 120-pounder Whitworth. The destructive effect of the old smooth-bore was greater than that of either of the rifled guns. Indeed, as far as a test of ordnance is concerned, the experiments of Tuesday possess no great value. The Horsfall monster gun and the 150-pounder Armstrong (erroneously called a 300-pounder) were wanting to thoroughly test a target of such weight and thickness. The indentations produced by the sixty-eight were about an inch and a half in depth, those by the rifled projectiles falling short of this. It is said that the success of the experiments was due in a great measure to the excellent quality of the iron plates, which are hammered plates, manufactured at Millwall Ironworks. The only interesting question which these experiments has decided is one that has lately been the subject of much conjecture with many, viz., What would become of the Whitworth flat-headed homogeneous iron or steel projectile when it met sufficient strength to resist penetration? That question is now decided. It goes to pieces. Some surprise was manifested at the absence of the punching operation, which the Whitworth projectile performed with ease in the case of 4½ or 5 in. plates. But all mechanical experience proves that the diameter of the punch must equal, if not exceed, the thickness of the plate, and therefore it is simply impossible that a projectile 7 in. in diameter could punch a hole in a plate 7¾ in. in thickness. The fact that the rifled projectiles destroyed themselves so completely partly explains why, with a charge of 50 per cent. more powder, they did less damage than the round shot of the old smooth bore.

SINKING OF A RAILWAY VIADUCT AT CLAPHAM.

On Wednesday morning an occurrence of a serious nature, though fortunately unattended with any loss of life or bodily injury, took place near the Clapham station of the Metropolitan Extension of the London, Chatham, and Dover Railway, by which the through traffic on the line will have to be suspended for some time to come. It will doubtless be remembered that that part of the Metropolitan Extension Railway, which is to join the Victoria Station at Pimlico by a bridge across the Thames at Blackfriars with the Farringdon-street terminus, was opened a short time back from Victoria to the Elephant and Castle. The second station on the line is that at Clapham, and at about 200 yards distant the line crosses the Clapham-road and the Bedford-road by means of iron-girder bridges. Between these two bridges is a viaduct, consisting of nine arches of massive brickwork, standing in a field. All the structure appeared to be quite safe up to the evening of Tuesday, when there were slight indications in the parapet of a subsidence of one of the centre piers taking place. The officials of the company were at once apprised of the fact, and every precaution was taken for the safety of the public by watching, &c. On Wednesday morning, at about half-past six o'clock, the men on watch found that the pier began to sink rapidly, and before long it had subsided upwards of four feet into the earth, carrying with it the next pier, and, as a matter of course, the centre arch and portions of the arches on each side. Notwithstanding this great sinking, and the manner in which a large portion of the brickwork had become broken up, the rails did not give way for some time. Information was at once sent up to the Victoria terminus, as a train was to leave at 7.25, and the working beyond Clapham was stopped. Almost immediately a large body of workmen were on the spot, and the traffic between the Clapham and Brixton stations having been suspended, steps were taken to shore up the arches on both sides of those damaged.

At an early hour the chief engineer of the line, Mr. George Cubitt, with Mr. Turner and Mr. Thomas, of the engineering staff, and other gentleman, visited the spot, and examined the sunken piers and damaged arches, and, from their inspection, there is no doubt that the whole must have given bodily, as there was not the slightest appearance of defect in the brickwork, which is of the best description. It seems certain that the pier on the Clapham-road side must have gone first, carrying the other portion with it. As to the cause of the subsiding of the pier, no positive reason can be assigned. The foundations were laid on the solid gravel, and as there is no knowledge of the existence of any old sewer in the vicinity, the conclusion arrived at is, that there is a peat bottom at some considerable depth below the gravel on which the foundations rested. However, men were employed all day in taking down the damaged arches, and when the brickwork is removed, the foundations will be dug out, and the exact cause will, no doubt, become apparent.

MANUFACTURE OF WROUGHT-IRON DIRECT FROM THE ORE.

(From Truran's "Iron Manufacture of Great Britain.")

The production of wrought-iron direct from the ore—the original mode of manufacturing—has engaged the attention of numerous practical and scientific men, and is practised to a limited extent abroad; but the attempts made to reinstate it in this country, have hitherto been, commercially speaking, unsuccessful; and though the ores and fuels we possess are unquestionably superior to the foreign for this purpose, fusion in the blast furnace, and conversion into malleable iron by the puddling process, is pursued with all the bar iron now manufactured.

The conversion direct into malleable iron dispenses with the blast furnace and appendages, and the intermediate processes of refining and puddling, and if successful, should result in the production of a finished bar of superior quality, with a smaller consumption of ore at a proportionately lower cost. In all experiments on converting on this plan, the bar is of inferior quality, the consumption of ore larger, and the cost of production augmented over that attending the manufacture by blast furnaces and refineries. The causes tending to produce this difference between the results of theory and practice are numerous, but will receive from us only a brief notice.

The ore to be converted is ground to a coarse powder, and in mixture with a quantity of carbonaceous matter similarly divided, is charged into a reverberatory furnace not unlike the ordinary puddling furnace. The draught is forced to the production of a high temperature, reducing the ore to a semi-liquid state, when by dexterous manipulation on the part of the operative, metallic iron is separated from the extraneous matter, balled up, and shingled as in the usual manner. The theory of this operation is simple. The carbon of the carbonaceous matter is consumed by uniting with the oxygen of the ore, and the metal is left free to agglutinate into a mass. The Beaufort black band was thus converted into malleable iron, though after a few experimental trials the operation was discontinued. The principal objection to its extensive adoption, seems to lie in the difficulty of effecting a complete separation of the extraneous metalloids of the ore. In the blast furnace it is accomplished by mechanical subsidation in the hearth, and the extraction of the metallic iron from the low level; in the direct mode of manufacturing it is effected to a certain degree, by severe manual labour, which being skilled, commands a comparatively high price, and materially enhances the expenses incident to the process.

The prolonged exposure of the metallic iron to the oxydizing influence of the flame and gases during the process of separation from the alloyed matters, results in a considerable waste of metal, and accounts for the comparatively inferior yields.

To obviate this loss, and to economize the fuel, and labour demanded, the ground ore and carbonaceous matter have been subjected to the necessary heat in a closed supplementary chamber, whereby the combustion of the carbon is slowly carried on at the expense of the oxygen of the ore, but at a sufficiently low temperature to avoid oxydizing the mass. From this chamber it is drawn as required into the furnace, balled up and shingled, the deoxydized ore agglutinating without undergoing the puddling process, which being essentially a decarburizing process is unnecessary with the minimum volume of carbon consumed in the deoxydation of the ore in the close chamber.

Ground carbonaceous ore may be substituted for the carbonaceous matter, and mixed in the necessary proportions with the same ore calcined, or, with raw hermanite, the deoxydation can be effected without the usual ground coal, at a corresponding reduction in the expense. In this respect, the possession of ores of such varied character, gives the ironmasters of this country an important advantage over their foreign compeers; and, should this mode of manufacture, at some future day, become more profitable than at present, would enable them to maintain their supremacy in the trade. The rich carbonaceous ores of Scotland or Wales, mixed with the hematites of Lancashire or West Cumberland, or other similar ores, reduced in suitably constructed furnaces, may be converted into malleable iron, at costs considerably under those incurred with the blast furnaces and subsequent decarburizing system.

With existing modes of operation, the advantages of direct conversion are principally confined to the comparatively small capital required to establish the manufacture, which may be on the smallest scale, yet, to a corresponding extent, profitable. Hence it is especially applicable to new districts, requiring an immediate small supply, and to countries deficient in the capital necessary for carrying on operations on a large scale with blast furnaces, and attendant refining and puddling furnaces. To establish on a sound basis works consisting of blast furnaces, refineries, puddling forges, and rolling mills, a capital of at least £20,000 per blast furnace, where there are four, is required; with a fewer number, more. In the direct mode wrought iron in proportionately smaller quantity may be manufactured, with a capital of only one-twentieth, or one-thirtieth of this sum. In this respect, therefore, it is more advantageous, and may consequently, under certain circumstances, merit the preference over the established system.

Legal Intelligence.

COURT OF BANKRUPTCY.—Dec. 29.

(Before Mr. Commissioner Golburn).

Re Bastier.—This was the adjourned sitting for examination and discharge. The bankrupt was described as an engineer, of Manchester-buildings, Westminster. Mr. Sargood opposed for the directors of the Graving Dock Company, of Liverpool. The bankrupt was the patentee of a chain pump, and he had employed the opposing creditors to construct several pumps on his patent, one of which had been exhibited in the Exhibition. He had paid nothing, and the pumps were gone.—The bankrupt, in a letter which he had written to the Court in very amusing English, alleged that he had spent £4,000 in this country.—His Honour adjourned the examination *sine die*.

SMOKE CONSUMING APPARATUS.

On Tuesday last Mr. Charles Young, solicitor, accompanied by Mr. William Sandison, the engineer appointed by Government to carry out the provisions of the Smoke Nuisance Act, came before Mr. Woolrych, at the Thames Police Court, and reminded him that on the 15th of November last Mr. John Fairrie, the extensive sugar-refiner, of the Commercial-road East, in the hamlet of Mile-end Old-town, was fined £5 for unlawfully using a certain furnace not constructed so as to consume its own smoke. At the same time it was arranged that the fine should not be enforced for six weeks, if the defendant used the best practicable means to comply with the requirements of the law. Mr. Sandison believed that Mr. Fairrie had used every possible effort to obtain a proper apparatus, and, after spending a considerable sum of money, had failed. Mr. Fairrie had given orders for another apparatus, and he now asked for another adjournment, to enable Mr. Fairrie to complete the necessary alterations and improvements.

Mr. Charles Young said that Mr. Fairrie had expended £75 since the 15th of November in applying a smoke-consuming apparatus to one furnace. It was a failure, and he had to begin again. Mr. Fairrie intended to spend £700 in applying an apparatus for the consumption of smoke to each of his seven furnaces.

Mr. Woolrych: Will a smoke-consuming apparatus for each furnace cost £100?

Mr. Charles Young: Yes, it will indeed, sir.

Mr. Woolrych was glad, for the sake of the public, that there was a prospect of a speedy discontinuance of the dense volumes of black smoke from the chimney-shaft of Mr. Farrie's extensive sugar refinery.

Mr. Charles Young: The works will be proceeded with as rapidly as circumstances will permit.

Mr. Sandison asked for the costs. The charge for two inspections of the furnaces is £2 2s.

Mr. Charles Young: My client will pay the £2 2s.

Mr. Woolrych: Very well. The penalty will not be enforced at present. The case is adjourned for six weeks.

Meetings for the Week.

Mon.—*London Inst.*, "On Sculpture," by R. Westmacott, Esq., R.A., at 7 p.m.
Tues.—*Royal Inst.*, "On Air and Water" (juvenile lecture), by Professor Frankland, at 3 p.m.
Wed.—*London Inst.*, "On the Operation of Heat," by E. W, Brayley, Esq., at 7 p.m.
Geological Soc., Special General Meeting.
Thur.—*Royal Soc.*, at 8.30 p.m.
Civil and Mechanical Engineers' Soc., "On Warren's Triangular Girders," by J. B. Walton, Esq., at 7.30 p.m.
Royal Inst., "On Air and Water" (juvenile (lecture), by Professor Frankland, at 3 p.m.
Fri. — *London Inst.*, "On the Chemistry of the Non-Metalic Elements," by F. Field, Esq., at 7 p.m.
Architectural Assoc., "Architectual Criticism," by L. W. Ridge, at 8 p.m.

The Ottoman National Exhibition.—Notwithstanding the severe weather which has prevailed during the greater part of the past week, the building in the Hippodrome has been actively proceeded with by crowds of workmen. By the end of the month the entire shell of the structure will, it is expected, be complete and ready to receive the roof, which it has now been decided shall be of glass. Azim Bey has been named Imperial Commissioner—whatever that may mean—for the enterprise, and is already at work with Mustapha Pasha on the details of the allotment of space, the classification of the expected contents, and other executive duties of the undertaking. The week's news from the provinces reports favourably for the progress of preparations among intending exhibitors. From Bagdad the telegraph states the goods to be ready for transmission. Similar intelligence comes from Aleppo, Adrianople, and Upper Albania, from the last of which an extensive display of native arms is promised. These will be arranged as a trophy near the entrance of the building, as *vis-a-vis* to another to be formed of cannon and small arms manufactured at Zeitoun-Burnou. Splendid specimens of embroidery are promised from some of the chief harems of the capital, where the fair candidates for medals and "honourable mention" are now busy with this object. A special day in the week, by the way, is to be set apart for the admission of ladies to the building, on which the unfair sex will be rigorously excluded—as will be the houris themselves on the other six. As intending English exhibitors have yet ample time to obtain the requisite space for their goods, it may be worth while to express our conviction that agricultural implement makers will especially find the experiment a paying one, as their articles, above all others, are sure to find ready and liberal purchasers at the close of the exhibition.—*Levant Herald.*

Scottish Institute of Civil Engineers.—On the 24th ult., the usual monthly meeting of this Institute was held in the Philosophical Society's Hall, George-street; Professor Macquorn Rankine, in the absence of the President, in the chair. Five new members and one graduate were unanimously elected; after which the Institute agreed to remit to their council to appoint a committee to assist in making arrangements with the Philosophical Society of Glasgow for a *conversazione* in the end of January. The adjourned discussion on "Experiments on Wrought-Iron and Steel," by Mr. D. Kirkaldy, was then resumed and finished. A paper was then read, "On obtaining Fresh Water by Evaporation," by Mr. George Russell, a new apparatus being shown in explanation of the paper. Mr. John Warner, of Pennsylvania, described an instrument for aiding in the computation of earthwork.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our Correspondents.*]

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THE TENSILE STRENGTH OF IRON AND STEEL.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In your last issue I have perused with great interest a paper read by Mr. David Kirkaldy, detailing the results of an experimental enquiry into the comparative *tensile strength* of iron and steel. My attention has been arrested by two statements: the first is par. 35—that steel is reduced in strength by being hardened in water, and that its strength is vastly increased by its being hardened in oil. This appears to me, though partly correct in fact, yet altogether erroneously expressed. I am aware that gunsmiths, and other fine workers in iron, use oil instead of water in tempering steel, and I have done so myself repeatedly in India, where a person is often obliged to do much for oneself that in England can be better done for you; but I always considered that the advantage was chiefly owing to the lower temperature of the oil kept in the house, and to the less immediate transmission of heat through the oil as compared with water, thereby causing the process of cooling or tempering the steel to be *less sudden*. There is, besides this, another advantage arising from this use of oil, namely, that it leaves on the tempered surface a film of protective varnish which in India, where iron and steel so quickly oxidise, is of no small profit.

But, if I am correct in supposing these to be the sole advantages arising from the use of oil instead of water, then assuredly it is a mistake, in a practical paper like this, to ascribe to oil, as oil, the virtue of toughening steel by its being dipped therein at a certain temperature.

It would lead unscientific men to conclude that the oil permeated the interior structure of the heated metal, and being absorbed by it, cooled it and toughened it; whereas, all men who really know anything about the structure of metals, and the nature of oil and water, know this to be simply impossible.

The *direct* action of the water and oil is solely on the surface of the metal; but if that surface be less suddenly cooled in oil than in water, there is, besides, an indirect action on the interior of the mass, inasmuch as heat is abstracted from it also less suddenly, and it becomes, therefore, when tempered, less hard, less brittle, and more tough.

The higher you raise the temperature of the steel which is to be tempered, and the colder the fluid into which you plunge it, the harder and more brittle it becomes. Thus, in India, glaziers never use a diamond to cut glass, but they do all their work with a steel point, hardened as I have above described. I have hardened steel myself so that it was as brittle as glass itself, by plunging it at nearly a white heat into iced water.

But once it is admitted that the *direct* action of the fluid is only on the surface of the metal, it follows that the description given conveys an erroneous impression, likely to mislead, to induce misconception and error; in short, to do more harm than good; because the result does not arise from the lubricating qualities of the oil, but rather from its being at a lower temperature, or from its absorbing heat less readily than water; for we might easily substitute some aqueous compound that would answer the same purpose—say, earth and water, or flour or glue and water, or any such mixture of greater or less density and specific gravity than water. Glue in particular appears to me likely to have the most admirable effect, seeing that case hardening is still effected by surrounding iron with scraps of leather and other animal substances, and subjecting the whole to prolonged heat.

The second statement which I advert to is, that it was (par. 62) previously believed that the density of iron was increased by wire drawing, whereas it is now ascertained to be decreased by cold rolling as well as drawing.

Certainly, *I* never imagined that stretching iron could increase its density. Take, for instance, a piece of dough; if you pull it out you increase its size, but you decrease its density and specific gravity.

Thus, also, a piece of lead: strike it a sharp blow with a large hammer, you make a circular dent or depression on its surface; you have increased its density, and if you could attach two suckers to the depressed surface, so firmly that they should not be detached when sufficient exterior strain may be exerted to pull out the lead to its original dimensions, it is very evident that you would thereby decrease the density of the compressed lead, and bring it back to its original state. And even thus is the drawing of iron or steel wire: you pull it out by means of powerful leverage, and distend it so that it occupies greater space than it did before; it consequently, and necessarily, weighs less in comparison to its bulk.

So much for the consequences of wire drawing metal; but, as regards cold rolling, I feel inclined, like the sages of old, to question the fact alleged by the king, that you might fill a bowl of water *quite full*, and yet that the addition of fish thereunto would not cause it to overflow. I have never tested rolling operations, and must therefore write with reserve and diffidence; but it is my firm impression, that a first process of cold rolling steel or iron would increase, and not decrease, its density. I mean, that if an iron bar were passed cold through steel rollers, set so far apart that they would exert such pressure only as would very slightly decrease its thickness, I believe that the density of the iron bar would be found to be increased and not decreased. I would, of course, not deny that were thin iron wire to be formed by passing it through a gradation of steel rollers, instead of the usual process of drawing, it might suffer a decrease of density; but I maintain that if a drawn wire were to be subjected to a slight pressure through rollers, its density would be thereby increased, and not decreased; and it appears to me that an interesting experiment might be made as to whether steel wire, as required for the use of pianoforte makers, might not be strengthened and improved in tone, either by being made solely by cold rolling, or by being subjected to rollers, as above described, subsequent to being drawn out. Certainly, if not for England, it seems to me that wire for pianofortes sent out to India and other hot and dry climates, where pianoforte wires not unfrequently snap, would be an advantage and improvement.

I am, &c., Chas. Bathoe.
28, York-place, Portman-square.
Dec. 27th, 1862.

Sir,—In perusing the valuable paper in your last issue, detailing the conclusions arrived at by Mr. Kirkaldy regarding the tensile strength of iron and steel, a few questions suggest themselves.

Does not section 23 somewhat contradict section 8? for this "skin" (admitted by Mr. Kirkaldy to be harder than the inner part), being removed by turning, must surely leave the bar less strong than before?

How are we to understand section 18?—"Iron invariably presents a crystalline appearance when fractured suddenly, but a fibrous when fractured slowly." Does he mean to say, that the interior of a bar of iron, when entire, is in neither of these states, but is *turned into* one or the other, according to the method of breakage? Are we to understand that the appearance of the fractured section is no guide to the internal structure of the remainder of the mass? For instance, that having a homogenous bar 2 ft. long, we may, 6 in. from one end, fracturing it suddenly, find it crystalline, and 6 in. from the other, fracturing it gradually, find it fibrous? If so, how close may the two fractures be brought, without interfering with this phenomenon?

And in section 48 we read, "the amount borne was much less when the diameter was uniform for some inches of the length than when confined to a small portion."

Does this mean, that if we had a bar 10 ft. long, of which 6 ft. were 2 in. in diameter, and the remainder only 1 in., that we should *increase* the breaking strain by reducing 9½ ft. length to the smaller amount, and leaving only ½ ft. in length, 2 in. in diameter?

I do not pretend to say these things cannot be correct, but they sound rather strange to
Your obedient servant,
Dec. 27th, 1862. Ignoramus.

SILICA OF POTASH.

Sir,—Will you have the kindness to allow me, through the medium of your valuable paper, to ask some of your numerous correspondents how to make silica of potash, so as to become soluble in boiling water. I have just past through some experiments, with a view of obtaining a silica of potash, soluble in boiling water, but failed to obtain such a result. My mode of proceedure was as follows:—I took 15 parts of quartz sand, 10 parts of carbonate of potash, and 4 parts of charcoal, in powder, mixed them, placed them in a crucible, and subjected them to a strong heat in a brass caster's furnace, until it was melted so as to run from the crucible, while in the melted state, like treacle; when cold it had the appearance of a black slag, very hard; when pounded and ground to a fine powder, its colour was grey. I then boiled it for five hours, constantly stirring it, and keeping it up to a boiling point. If some kind correspondent can give me the *right* mixture and process, or will point out the cause of the failure of the above method, I should esteem it a great favour.

I am, &c.,

Dec. 29th, 1862. J. B. B.

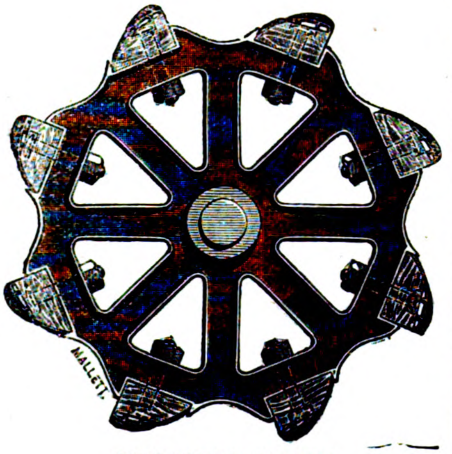
GOUCHER'S BEATER FOR THRASHING MACHINES.

SIR,—I should be obliged by the insertion of the enclosed drawing and description of my patent beater drum for machines for thrashing corn and other grain, at an early period in your excellent Magazine.

Previously to the application of steam power to work the thrashing machine, the drum beater was so imperfectly constructed, even at the low velocity at which it was driven, as to crush the grain and break the straw in a very prejudicial manner; and to avoid those serious results, and to adapt the drum to be driven at an increased velocity, I devised and patented the beater with grooves in its surfaces, and its improved construction patented in 1860.

The peculiar construction of the improved beaters consists in the working sides of the grooves being vertical, and the other sides inclined and rounded, which, being thus formed, permanently retain their keen thrashing surfaces, and secure the two very important advantages over all other beater drums in the operation of thrashing, namely, every corn is thrashed out of the ear uninjured, leaving the straw straight and unbroken. Upwards of 4,000 of these drums are in use in the United Kingdom, on the Continent of Europe, and in Australia.

FIG. 4.



CROSS SECTION OF DRUM.

Figs. 1 and 2 show a longitudinal section and plans of a portion of a beater, *a a* being the working surface, and *b* the under surface. Fig. 3 is a transverse section of beater plate, showing the method of securing it to the wooden bar. Fig. 4 is an end view of the beater drum, showing the method of securing the wooden bar to the drum ends. The beater plates and drum ends are composed of malleable cast iron.

I am, &c.,
JOHN GOUCHER.
Church Walk Ironworks, Worksop, Notts.
Dec. 22, 1862.

GOUCHER'S BEATER FOR THRASHING MACHINE.

LONGITUDINAL SECTION.

FIG. 1.

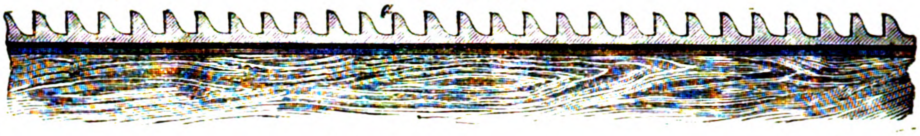
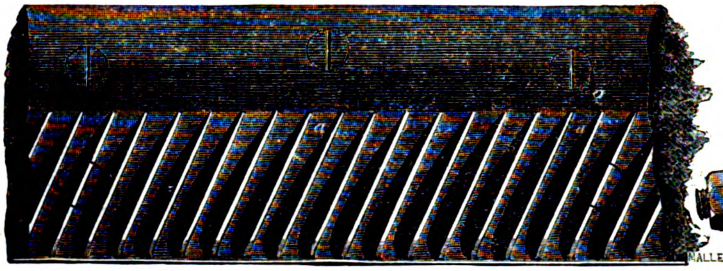
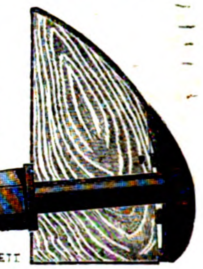


FIG. 2.



PLAN OF BEATER.

FIG. 3.



SECTION.

For the past three or four years, says the *Morning Herald*, Lord Clarence Paget and the Duke of Somerset have been spending the modest sum of £250,000 a week, £1,000,000 a month, and £12,000,000 a year, and still the very things which should have been done with the money remain undone. The consequence is, the Admiraly is, at the moment, in a mess.

Gossip.

The French Mint is preparing some new copper money, on which the Emperor is represented surrounded by laurels. It is said that this design will be adopted on all the French coins, and on the postage stamps also.

About a fortnight since the gunboats "Cairo," "Marmora," and "Signal" ascending the Yazoo River, reached a point a mile below Hayne's Bluff, U.S., when a torpedo exploded under the "Cairo," shattering her bow. She sank in fifteen minuites, in forty feet of water, and cannot be raised. No lives were lost. The "Cairo" was one of the first iron-clad gun boats built for service on the western rivers, and participated in the capture of Forts Henry and Donelson.

Messrs. Spill and Co., of Hackney-wick, have, after many strenuous exertions, managed to make excellent india rubber driving bands. These bands, have, we are informed, been subjected to severe official tests with complete success.

Amongst the preparations Mr. Fechter is making for the opening ofthe Lyceum Theatre on the 10th, is one consisting in the new arrangements for lighting. The chandeliers round the boxes will be removed, and the theatre will be lighted by Messrs. J. Defries and Sons "Patent Sunlights."

On Tuesday last Colonel Yolland, R.E., the Government Inspector of Railways, made another trip along the Metropolitan Railway line. Messrs. Tanner, Fenton, Johnson, and other officials were present. The train, consisting of an engine and carriage, started from Paddington about 11-50, a.m., along the up-line to Farringdon-street station. After a careful examination of the altered signals and the electrical indicators which have been furnished for the purpose of showing the position of the distant semaphores, the train returned along the down-line of rails to Paddington. The result of this further investigation is the entire removal of all opposition, on the part of the Board of Trade, to the immediate opening of the line. This is, howerer, again postponed till Saturday, the 10th of January, while the inauguration banquet is expected to come off the 7th instant. The banquet room is being gorgeously decorated for the occasion.

The Russian Government has commenced the development of an iron navy. Messrs. C. Mitchell and Co., the extensive shipbuilders, of Newcastle-on-Tyne, have been intrusted with all the arrangements necessary to convert the Government dock yard at St. Petersburg into an iron ship building yard. Steam engines, punching, shearing, and other machines of the most modern construction, have been sent out from Manchester and London. A railway will traverse the dockyard and communicate with the workshops and building slips. Steam travelling cranes will be erected over the vessels while in course of construction, thus performing the greatest amount of work by means of mechanical appliances.

Advices received from Philadephia state that the fibre of the plant Hibiscos Moscheutos is occupying the attention of the merchants at that port as a substitute for linen rags and jute. This plant is indigenous to the Northern States, and grows in abundance in the swampy lands of Pennsylvania, New Jersey, New York, &c. At a moderate calculation, and taking into account the probability of loss from unforesen causes, three and a half tons of disintegrated fibre can be derived from one acre of ground. Two prominent paper manufacturers of New York have estimated the fibre to be worth 100 dols. per ton, to be used as a substitute for linen rags in the manufacture of paper.

A letter has been published stating that Mr. Bright's firm, at Rochdale, is losing from £7,000 to £8,000 per annum, by running its mills, independently of what they are giving away, which can never be known.

The French treaty is benefiting France and England more than Mr. Cobden, or the French Emperor anticipated. There were imported from this country to France 18,500,000f. worth of machinery in 1861, and 25,800,000f. worth in 1862.

The committee appointed to test the merits of the Armstrong and Whitworth guns will consist of the following officers:—Major-General Rumley, Inspector-General of Infantry, president; Colonel Taylor, R.A., Commandant of the School of Gunnery; Major Young, R.A., Director of Artillery Studies; Colonel Simmons, C.B., R.E.; Captain Preedy, C.B., R.N.; and Commander Sluger, R.N.; with Captain Dyer, R.A., secretary. It is to be observed that the members have not previously served on similar inquiries, and are free from official bias as regards the merits of either invention.

The precise sites of the proposed new metropolitan bridges across the Thames are defined by the plans and sections just deposited with both Houses of Parliament and clerks of the peace. They are five in number—namely, the Tower-bridge, St. Paul's-bridge, the Temple-bridge, New Chelsea and Battersea-bridge, and Wandsworth-bridge; the first three for foot passengers only, and the other two for both carriages and horses. The time specified for the completion of the bridges is six years, and the toll to be taken is one half-penny.

The Mormons are turning their attention to the cultivation of cotton.

The New York papers boast of an invention which will destroy iron-clads, the most impregnable of them being as unprotected against it as a wooden vessel against a 500 lb. ball. The inventor is an engineer in the pay of the Government—has been in the Naval Engineer corps for years, and while attached to the man-of-war, "Kearsarge," in the Mediterranean, conceived the idea which is to revolutionize even the latest modes of naval warfare. The gentleman alluded to was recalled from the Mediterranean, and arrived some weeks ago. He visited the Navy Department, and laid before a somewhat incredulous board the nature of his extraordinary plan. His scheme is to get a fair and impartial trial, and an iron-clad man-of-war, now in course of construction, has been turned over to him that he may have his machine fixed to his satisfaction.

At a meeting of the Liverpool School of Science, for the distribution of prizes, on Friday last, Dr. Fairbairn alluded to our transition state with regard to shipbuilding, and ordnance generally; observing that our naval architects had now to contend against shot of 300 lbs. weight striking a ship with a velocity of 15,000 ft. per second; and as this weight, multiplied into the square of the velocity, gave the amount of the shock sustained by the ship, it was easy to conceive the amount of the injury which was produced by ordnance of the large calibre now adopted. A great deal remained yet to be done before we could declare the British flag and British ship to be invulnerable; but nevertheless he (the speaker) believed that by a thorough and earnest devotion to the sciences which bore upon shipbuilding, and the construction of ordnance, we should continue to maintain the supremacy of England on the seas.

A short time since a paragraph appeared in the Boston *Journal*, headed "A Singular Shot," and stating that, at the navy yard at Washington, a 130-pound solid shot fired from a 10-inch smooth bore Dahlgren gun, at a distance of 500 yards from the target, penetrated 4 in. of iron-plating and 10 in. of white oak planking. A correspondent at Washington, who witnessed the experiment, writes to the *Journal*, in order that the facts of the experiment may be stated. He says:—"A 10-inch Dahlgren was charged with 30 pounds of powder and a 130-pound solid shot, and was fired by means of a slow match. The shot made a clean hole through the target, which is composed of one iron plate, 4½ in. thick, and six other plates each 1 in. thick, bolted to a framework of white oak planking 18 in. thick. The target may be about 500 yards distance. These are the main facts as I observed them. Our English and French friends won't think we have made much progress if, on extra occasions, we can only get through 4 in. of iron and a 10-inch oak plank."

A fortnight since a telegraphic despatch was sent from New York city, between three and four o'clock in the afternoon, to San Francisco, and an answer received between six and seven in the evening!

During the battle of Fredericksburgh, the Federals resorted to ballooning to ascertain the position of the Conferate army. The balloon, says a correspondent, rose high in the regions of the upper air, to get a better view of the enemy's land. The morning mist and cannon smoke caused it to come down again. Afterwards, when the atmosphere became clear, it was sent up a second time; this time with better success. One of the rebel batteries directed one of their shells at it. The dangerous missile whistled by its mammoth form in hazardous proximity, but, happily, did no harm to the aerial observers or those congregated in the vicinity.

It always affords us satisfaction to record the results of some successful experiments on iron-plates, to prevent oxidation and fouling. On the 13th of September last, says the *Times*:—Mr. Roper, of New-cross, repaired to Portsmouth, by direction of the Lords of the Admiralty, to prepare a sample of his coating for iron plates to prevent oxidation and to keep clean the bottoms of iron ships. An old and decayed boiler-plate was selected for the purpose, coated with Mr. Roper's preparations, and afterwards sunk within the piers of one of the dockyard jetties. This plate was yesterday raised and examined by the master-shipwright and his staff, and found to be in a very satisfactory condition. Owing to the shortness of the time which the plate has lain under water, it was agreed to prolong the further test of the plate to three months, when more definite results will be obtained. A second plate is also to be prepared by Mr. Roper, in order to furnish the Admiralty with further proof of the anti-corrosive qualities claimed by him for his patent composition. A plate tested at Sheerness Dockyard, and reported upon by Mr. Moody, master-shipwright, has, we are informed, been attended with highly favourable results. We have before referred to the numberless inventions of this kind which have been brought under the notice of the Admiralty, and the failure of the greater number. In fact, no one system has yet been found to possess all the required advantages, and it is now being urged by scientific men that the only plan for securing these advantages is by a system of electrotyping—by depositing zinc, brass, or any alloy upon the plates with a bright enamel surface. A proposal of this kind is now being brought under the notice of the Admiralty.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 1683, 1688.
Boilers and Furnaces—*none.*
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1676, 1677, 1689, 1694.
Ships and Boats, including their fittings—*none.*
Cultivation of the Soil, including agricultural implements and machines, 1681, 1690.
Food and Beverages, including apparatus for preparing food for men and animals, 1684, 1686.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1651, 1655, 1656, 1658, 1665, 1666, 1679, 1685.
Buildings and Building Materials, 1652, 1659, 1682.
Lighting, Heating, and Ventilating, 1670, 1671, 1692, 1696.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1657, 1663, 1668, 1669, 1674, 1698.
Metals, including apparatus for their manufacture, 1661.
Chemistry and Photography—*none.*
Electrical Apparatus—*none.*
Warfare, 1653, 1667.
Letter-Press Printing—*none.*
Miscellaneous, 1654, 1660, 1662, 1667, 1673, 1675, 1678, 1680, 1691, 1693, 1695, 1697, 1700.

1629. J. Morrisson. *Improvements in the construction of springs suitable for ladies' dresses or crinolines, and for chair, sofa, and other seatings, as well as for bedstead and couch sackings.* Dated May 30, 1862.

This consists in twisting, coiling, or spinning flat strips or ribbons of steel, of any width, into a hollow archimedial screw or spiral tube, and applying the same when hardened and tempered to the purpose designated in the title. *Patent abandoned.*

1630. C. O. Staunton. *Improvements in apparatus for signalling and indicating the position of shots on targets in rifle practice and for preventing accidents to the markers.* Dated May 30, 1862.

Here the inventor constructs an upright framework made of wood, metal, or other material, at the top of which he fixes a rod or shaft, and places on it a number of pulleys, which are connected to other pulleys near the bottom of the framework by bands or gearing. To the top pulleys are connected arms carrying discs, and fixed to the shafts of the bottom pulleys; on the exterior framework are handles for working these discs. The discs are painted the requisite colours, such as red for "danger," white for an "outer," and on the framework around the handles for working the discs are painted discs to correspond with the ones at the top. The manner in which the invention is put into operation is as follows:—The marker has this apparatus before him, and when a shot is fired, he is enabled by the discs to indicate the spot at which the target has been struck: for instance, if an "outer" has been scored he turns the handle and displays the white disc at the top of the framework; if a "centre," the blue disc, and so on. The exact position of the shot on the target, whether to the right or left, high or low, can also be shown by inclining the discs in the same direction and at the requisite angle. When the danger signal has to be displayed, he inserts a pin through the handle into the framework to keep in its position. *Patent abandoned.*

1631. H. P. Burt. *Improvements in protecting wooden posts from decay, more particularly applicable to posts for supporting electric telegraph wires* Dated May 30, 1862.

This consists in protecting wooden posts or poles that are fixed in the ground from decay, by wholly or partially surrounding the lower end of the same, which is sunk in the ground with one or more receptacles, containing creosote, or other preservative solution or composition. *Patent completed.*

1632. R. C. Steed. *Improved apparatus for signalling on railways.* Dated May 30, 1862.

This is carried into effect as follows:—In the centre of the space between the "up" and the "down" lines of rails, and at regular distances, wheels are fixed vertically, their axes being supported in proper bearings, and having on their peripheries hand-spokes or levers, for adjusting the position of the wheels. At suitable parts of the peripheries of the wheels projecting arms or flanges are attached, the same being made of a partially elastic material, or so constructed as not to be rigid. Each engine is provided with a bell attached thereto, so that when the said wheels are placed with the arms or flanges at the top thereof, the bell is struck, thereby giving the signal of "danger" to the engine-driver. The bell is fixed to an arm projecting from the side of the engine, such arm being, if desired, partially elastic, and springs being placed on each side thereof, so as to assist the same in returning to its position after the bell has been struck. The wheels are connected together by ropes, wires, or chains, attached to the peripheries thereof, and holding the same in position. By turning the wheels a quarter round, the projecting arms or flanges can be raised or depressed, and the signals put "on" or "off" as may be desired.—*Patent abandoned*

1633. T. N. Pengelly and W. Byron. *Improvements in apparatus for hoisting goods.* Dated May 30, 1862.

Here the inventors mount a traversing nut on a long screw, fitted to rotate in suitable bearings. This screw has rather a rapid pitch, and traverses the nut when rotated, the nut being fitted in a suitable bar-piece, which traverses on guides. To this traversing bar they attach a rope or chain, the other end of which is wound on a barrel, on the same axis of which is fixed a larger barrel or drum, on which the twisting rope or chain is wound and the end fixed; one rope or chain winds in the opposite direction to that of the other, so that when tractive force is applied to unwind the one, it winds up the other, and so hoists the goods. Motion is communicated to the screw by steam or other power transmitted through suitable toothed gearing and catches, whereby the screw may be thrown in and out of gear at pleasure. In hoisting by this apparatus the travelling nut and its carrying bar on completing the necessary lift of the goods, strike against a lever, which operates a clutch fork mounted on the same axis, and so withdraws the gearing driving the screw, leaving it free. At the same time that the traversing bar disengages the gear by the clutch, it throws a weighted brake on to the drum, winding up the twisting rope which holds the goods hoisted in the elevated position until the attendant relieves the weighted brake by treading on a board, or other contrivance, which raises the weight, and relieves the brake, when the goods are free to descend.—*Patent abandoned.*

1634. W. Eddington, jun. *Improvements in apparatus for draining and tilling land.* Dated May 30, 1862.

This relates, 1, to connecting the fore part of a draining plough to the axle by a screw and nut, or otherwise, so that the plough can be raised or lowered as it travels along, thereby enabling the drain to be made level, or at a given incline, independently of the unevenness of the ground, which can be effected by turning the screw or nut by a wheel or handle connected therewith. The patentee places the screw or nut for raising or lowering the fore part of the plough in commuication with the travelling wheels by suitable gearing and clutches, so that the plough and drain may be gradually raised and lowered as it proceeds, whereby to cause a regular fall of the drain on flat lands. 2, To an improved rope for laying the pipes in the drain. The patentee threads on a small wire or rope a number of short tubes or sockets of wood on which the pipes are to be strung, which prevents the wear of the rope in passing through the drain pipes. 3, The patentee employs a framework carrying tines, in combination with a number of double or single torns or mould boards, placed at suitable distances, which follow behind the tines, so that the implement shall perform both scarifying and ridging at one operation. *Patent completed.*

1635. R. E Lofft. *Improvements in small firearms and cartridges.* Dated May 30, 1862.

This consists in fitting the breech end of the barrel with a small chamber, in which a point for the percussion of the detonating powder is disposed and fixed, such powder being contained in a tube which enters the small chamber alluded to, and which is driven up against the point for exploding the charge. *Patent abandoned.*

1636. J. Ives. *Improved machinery for washing and wringing clothes or fabrics.* Dated May 30, 1862.

This consists, principally, in the use of two or more elastic rollers made of vulcanized india-rubber, and mounted and actuated so that the surface speed of both these rollers will be always the same, and consequently there will be no tendency to rub or tear any article or fabric that may be passed between them. *Patent completed.*

1637. A. Gilbey. *Improvements in the construction of packing cases or boxes for holding bottles either full or empty.* Dated May 31, 1862.

This consists in forming cases so as to have certain shelves and supports upon which the bottles are balanced and rest, so that each bottle is isolated from the other and rests upon the shelves and supports. The junction of the neck with the shoulder of the bottle at the one end, and the portion at the bottom of the other end being the strongest parts of the bottle, the patentee arranges the shelves so that these parts shall be supported on whatever side the box may be turned. To effect this he places and fixes within the box, parallel to one of its faces, preferably the bottom, and a distance about equal to the length of the bottle's neck, a shelf, having a series of holes made in it equal to the other face of the box; and parallel with this shelf or partition he fixes another composed of intersecting rails or bars, similar to an ordinary bottle rack bin, composed so that the centre of each opening or space formed by the intersecting bars shall coincide, or nearly so, with the centre of each perforation in the other shelf. The next part of the invention relates to the method adapted in order to cause the lid of the box, when opened, to lie flat back so as to allow another box to be placed on the top, by which arrangement a series of boxes piled one on another will form a complete wire rack or bin. *Patent completed.*

1638. J. H. Holland. *An improvement in traction engines.* Dated May 31, 1862.

This consists in covering traction engines or locomotives, with their boilers, entirely from end to end, with roofs or sides of such a nature as to assimilate them in external appearance to modern omnibuses or railway cars. *Patent completed.*

1639. G. Ermen and R. Smith. *Certain improvements in machinery for spooling and balling sewing thread, silk, yarn, and other fibrous materials.* Dated May 31, 1862.

This consists, 1, in an improved plan, or arrangement, of the spindles upon which the spools are filled with thread. 2, In an improved spooling machine. 3, In an improved change motion for reversing the movement of the traversing frame at the end of each layer of thread as it is wound on the spools. 4, In an improved plan of varying the length of the traverse as the spool fills, which is effected by means of a left and right-handed screw driven by suitable gearing. *Patent completed.*

1640. W. T. Smallwood and W. Wright. *Improvements in waterclosets.* Dated May 31, 1862.

This consists, 1, in simplifying the constructing of the water conducting and stopping media, by placing the same at the front of the closet, 2, In so placing a valve or tap upon the service pipe, and coupling the same thereto, that it may be readily unshipped or detached and replaced at sea, or when out of repair, without removing or disturbing the other part of the closet, thereby rendering the operation capable of being performed by any ordinary workman or person unskilled in the manipulation of these articles. 3, In forming and fitting the plug of the stop tap so as to turn upon or within the spindle carrying a seated valve at the bottom of the soil pan, and in mounting a tumbler lever upon and between the said plug and spindle for actuating the sewer. 4, In so forming the male and female parts or couplings of the plug and spindle that one may be partially moved about their common axis independently of the other, thus providing the means by which a single lever is rendered capable of first opening the tap or valve on the service pipe, and then tipping the valve or pan at the bottom of the soil pan, or *vice versa.* *Patent completed.*

1641. A. Moreau and A. Ernest. *Improvements in electro magnetic machines or apparatus.* Dated May 31, 1862.

This consists in a method of combining and arranging the several parts of electro galvanic machines, whereby the intensity of the current is regulated with facility and a continuous current kept up, instead of giving it off by shocks as at present practised. *Patent completed.*

1642. J. V. De Verge. *A coating called "Enduit anhydro-carbonide," intended to protect iron from rust, and to preserve wood, cloth, paper, and pasteboard used for packing or roofing.* Dated May 31, 1862.

Here the inventor proposes protecting iron from oxydation, and preserving wood and other material by using the carbon produced in the distillation of coal in gas factories and which adheres to the sides of the retorts. This substance, reduced to an impalpable powder, forms a coating or colouring matter which, whether used in powder or mixed with the excipients used in painting, effects the above purposes. *Patent abandoned.*

1643. R. Shortridge. *Improvements in presses for pressing cotton and other articles.* Dated May 31, 1862.

This consists essentially in the employment of a box or well of wood or iron to contain the cotton, &c., to be pressed. The upper part of this box is open, and in it is fitted, loosely, a plate or follower of iron, which rests upon the cotton, which is raised and lowered as desired by a revolving-shaft, connected to the follower by certain suitable mechanical contrivances. *Patent completed.*

1644. D. A. Lamb. *Improvements in railway buffers, or apparatus to relieve concussion on railways.* Dated May 31, 1862.

Here the inventor uses a cylinder containing air, water, or other fluid. The cylinder is placed horizontally, and has a series of weighted valves upon it; a piston works in the cylinder, and at the end of the piston rod a buffer head is placed; this the inventor prefers should be of lead. When the buffer-head is struck, the piston is forced into the cylinder, and the air or fluid escapes by the valves, which are variously weighted, so that, according to the force of the blow, one or more of the valves open. *Patent abandoned.*

1645. H. Watson and J. Millbourn. *Improvements in pulp strainers or knotter-bottoms.* Dated May 31, 1862.

This applies to such strainers, or knotter-bottoms, as are composed of a series of bars, with spaces between them, and consists in forming them in a series of sections, or panels, each formed of a number of bars, which are combined by screw-bolts and nuts, or other fastenings. *Patent completed.*

1646. J. Butterley. *Improvements in ship building, and in rendering ships shot proof.* Dated May 31, 1862.

For the purposes of this invention, in constructing the ribs or framings of ships or vessels, where iron is used planked over with wood, in place of using the sections of iron heretofore employed for the ribs or framing, the patentee employs iron of the following section, generally known as grooved iron, viz., iron bars formed flat on the outer side or surface against which the wood is to be fixed, and formed on the inner side or surface, with flanges at the edges, so as to give strength to the bars, and so, at the same time, to render the inner side or surface suitable to receive the heads or ends of the bolts by which the wood planking is fixed to the ribs or framing; or, in place of the above section, iron of the following description, generally known as bulb iron, may be employed:- The iron ribs are placed transversely across the vessel, so that they run in a vertical direction from the keel upwards; the planks at the outside of this framing are fixed in a direction from stem to stern, or fore and aft; in the space between the ribs a further planking is used. Such second planking is parallel with the ribs, thus running in a vertical direction from the keel upwards; this planking is fixed to the previous planking by bolts, or in any convenient manner, and the seams of both the planking may be caulked. In order to construct a vessel capable of resisting shot, he employs iron frames, or ribs, such as are above described, and to these ribs or frames he bolts iron plates, running longitudinally of the vessel, the edges of the plates which are bolted to the ribs being provided with flanges. *Patent completed.*

1647. J. Villa. *A new and improved method of exhibiting terrestrial and astronomical phenomena, and of facilitating the solution of problems relating thereto, without the aid of calculation.* Dated May 31, 1862.

This consists, 1, Of a grand planisphere, which indicates the measure of time, having both hemispheres laid out with radial mediums and concentric latitudes, and with the antartic pole forming the centre. This planisphere being put in rotation, either by the hand or by clockwork, instantly gives the hour in all countries, and all the longitudinal differences in time, thereby easing geographical studies, and bringing in view all the lands and seas with the utmost convenience, so as to trace sea voyages, and to discover their antipodes. The equator and ecliptic will be found at their proper places, with all the positions of the sun. 2, Of a grand celestial planisphere with a terrestrial girdle. This planisphere represents the entire heavens on a singular circular plane, indicating all the constellations visible there, by the naked eye, in their angular positions. Surrounding this planisphere, there is a girdle in which is portrayed an epitome of all the countries of the earth, so that they may be found at once in their longitudinal positions. In this system the earth is made immoveable, and the celestial planisphere moves in sidereal time. *Patent abandoned.*

1648. F. F. Lawden. *Improvements in certain descriptions of single and double barrelled guns.* Dated May 31, 1862.

This relates to that description of breech-loading guns, known as "Lefaucheux's," and consists in means for locking the barrel or barrels in position. The invention also relates to that description of guns used as walking sticks. The barrel is jointed by being tapped and screwed or otherwise united above five-eighths of its length from the muzzle upward, and by this joint the breech of the barrel is exposed for receiving the charge, using for this purpose the metallic case cartridge and ball manufactured by Tipping and Lawden, in connection with Sharp's patent repeating breech loading pistol. *Patent completed.*

1649. G. C. Lingham and J. Nicklin. *An improved crinoline connector and suspender.* Dated May 31, 1862.

This consists in cutting out strips of metal by the aid of suitable press tools, with projecting ears at the ends, and in the middle, together with suitable teeth, that project in the proper direction for holding the crinoline to be encompassed. *Patent abandoned.*

1650. L. Chanbart. *An improved mode of raising the level of water in rivers, canals, and other watercourses, and in the apparatus connected therewith.* Dated May 31, 1862.

This consists in the construction of a self-acting and regulating bar, or sluice, applicable to watercourses in general. The bar, or sluice, is constructed in three different parts, which may be employed either together or separately. The details of construction are voluminous, and cannot be produced here *in extenso.* *Patent completed.*

1651. W. E. Newton. *Improvements in the treatment of cloth and other textures, leather, or animal tissues, for the purpose of rendering them more durable and impermeable to water and other fluids, and for producing from any fibrous texture, such as cloth, cotton, woollen, or mixed goods, a durable, artificial leather.* (A communication.) Dated May 31, 1862.

This consists, 1, in giving increased body, and durability, and impenetrability, to vegetable, woody, and animal, fibrous textures, as silks, woollens, leather, gelatinous tissue, prunella, cotton, &c., by first subjecting them to the action of a solution of alumina (or its basic salts), or other true mordant and gelatine, in such proportions, and so as to chemically combine the alumina and gelatine, and form an insoluble composition, which combines chemically with the fibre of the cloth, making the three a chemical compound, and, subsequently, subjecting the said goods to the series of actions, operations, or processes, of the chemical and other agents employed, as described, so that by the various processes and substances employed, substance is added to fibrous tissue, and the materials are chemically united together, thereby forming a compact body possessing great tenacity, flexibility, and, at the same time, being waterproof. 2, In producing artificial leather from any kind of firm cloth, cotton, woollen, or mixed goods, by first immersing the cloth in sulphate of alumina, or the true mordants, then in a solution of tamine, and subjecting it to the various processes, substances, manipulations, and applications, as set forth. *Patent completed.*

1652. W. K. Sullivan. *Improvements in the preservation of stone, plaster, cement, and other like matters, the invention being likewise applicable to the manufacture of artificial stone, and to the fixation and production of colours on and in the body of stone, plaster, or cement.* Dated May 31, 1862.

The chief object here is to impregnate stone, cement, &c., with chemical substances that will render the same impervious to, or capable of resisting the effects of damp. To this end the inventor applies fluo silicate of magnesia, fluo silicate of zinc, or other soluble fluo silicate, to the stone plaster or cement, and then decomposes the same by the applicaaion of a solution of an aluminate of potash or soda, or both, successively, or by a silicate of alumina, dissolved in an alkaline solution. He applies the solutions by a brush, syringe, or hose, in the case of buildings, or, where practicable, by immersion. In general, he prefers the stone, &c., to be damp, and, in order to make it so, he prefers applying a weak solution of silicate of potash instead of water, merely. *Patent abandoned.*

1653. W. E. Newton. *Improvements in the construction and operation of shot proof gun towers, and the working of the guns therein for sea vessels, floating harbour defences, forts, or land fortifications,* (A communication.) Dated May 31, 1862.

The principal points of novelty here are, 1, Placing the gun tower, shield, or cupola upon a rotating bed or base, and arranging the steam cylinders, and the necessary appliances for working them, and the tower, and the guns, so that they shall turn with the tower. 2, Connecting the gun carriage with the pistons of steam cylinders, so that the guns may not only be run out of their ports, or back into the tower by steam power, but that the recoil of the guns, when discharged, may be taken up or counteracted by the elastic force of the steam on the cylinders. 3, Making the gun tower cupola, or shietd of much smaller dimensions than has been heretofore proposed, and constructing in it sections something like a telescope gas holder, so that the top section may be lowered into the hold of the vessel when required for the pupose of lowering the centre of gravity of the vessel and thereby preventing it from rolling in a rough sea. 4, Levelling the gun in the tower, in the act of raising it by means of a projecting stud, pin, or stop piece, placed near its muzzle, in combination with a fixed guide on the tower, so that, as the gun rises, the stop piece therein, by coming in contact with a fixed guide, may so point the gun that a very small port only will be required, as the gun must by this arrangement for pointing it enter the port fairly without striking the sides of the port. *Patent completed.*

1654. B. Tanplar. *Improvements in apparatus for registering and indicating billiards and other games.* Dated June 2, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1655. J. King and J. Partington. *Certain improvements in looms for weaving.* Dated June 2, 1862.

This invention is not described apart from the drawings. *Patent completed,*

1656. J. Elce and W. J. Gradwell. *Certain improvements in machinery for spinning, doubling, and winding cotton and other fibrous substances.* Dated June 2, 1862.

The first part of this is particularly applicable to the machines for spinning called thrastles, and to other machines of the like nature for doubling and winding, in which two pin cylinders are used for driving the spindles by band, and it consists in causing the two cylinders to approach each other simultaneously, for the purpose of slackening the band when it is requisite to turn the spindles by hand for removing the flyers previous to doffing the fall bobbins, and for replacing the flyers. The second part is applicable to those machinery used in spinning, doubling, and carding, in which the spindles are driven by tapes passing over a centre cylinder, and then around guide pulleys supported in elbow levers, and it consists in actuating all the elbow levers on one side of the machine by a shaft and eccentrics, or other equivalent agents, for the purpose of slackening the tapes simultaneously. *Patent abandoned.*

1657. A. J. Sax. *Improvements in kettle, big, or other drums.* Dated June 2, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1658. T. Campbell. *Improvements in apparatus for "witneying" piled fabrics.* Dated June 2, 1862.

This consists in arranging the rubbers so as to diminish the pressure on the surface of the cloth or fabric, which the inventor effects by suspending the levers to which the rubbers are connected at such height above the surface of the cloth that heat is not evolved through the great pressure of the rubbers; also in applying heat through pipes or otherwise, for the purpose of imparting to the cloth or fabric the amount of heat required to facilitate the process of "witneying," thereby obviating the present inconvenience arising from the great pressure of the rubbers on the cloth or fabric. Also a kind of cushion of cotton pile, or other material, is fixed under the cloth, opposite to the operating surface of each rubber. *Patent abandoned.*

1659. C. H. Roeckner. *An improved method of constructing coffer dams and other similar structures for excluding or keeping back the flow of water, and preventing inundations.* Dated June 2, 1862.

This consists in driving piles across the bed of a river, or other water-course, at some distance from each other—say, 2, 3, or 4 ft. asunder, and in employing a strong woven material, or fabric, such as sail-cloth, rendered waterproof by any known means, for the purpose of keeping out the water, the fabric being placed along the pile, reaching from the top thereof to the bed of the river, or other water-course. *Patent abandoned.*

1660. J. Baker. *Improvements in pumps.* Dated June 2, 1862.

This relates to the arrangement and construction of pumps, more especially those of the portable kind, which are specially adapted for the use of horticulturalists, &c. According to one modification the pump consists of a brass barrel, to the lower end of which is attached a ring which is connected by two curved stays to a foot-plate beneath. To the lower part of the pump barrel is screwed the box or chamber in which the inlet valve is fitted. The extremity of the valve-box has screwed to it a short length of bent tubing, to the outer end of which is connected the flexible tubing which serves to convey the water from the source of supply to the pump. A disc valve is fitted in the inlet chamber, and this valve rises with the upward motion of the piston, and the water flows into the barrel. The piston is of the ordinary kind, and is attached to a rod passing out through a stuffing-box at the upper end of the barrel, and terminating in a cross handle or hand lever. The downward pressure of the piston forces the water through a laterally projecting tube, which communicales with the outlet valve chamber. The outlet valve opens upwards into a small chamber of a spheroidal figure, the upper part of which communicates with the outlet tube: to this is screwed the flexible tube and jet-piece for directing the stream of water in any required direction. *Patent abandoned*

1661. J. Key and F. Potts. *Certain means of producing designs in iron, and in the application of the same, or designs formed in like manner of other metals to the manufacturing and ornamenting of bedsteads and other metal articles of furniture.* Dated June 2, 1862.

The patentee claims the applidation of the process of rolling to the production of designs in wrought-iron, the same to be used for the manufacture of metallic bedsteads, couches, chairs, flower-stands, &c., &c., as described. *Patent completed.*

1662. C. E. Gray. *Improvements to apparatus for extracting, rendering, receiving, purifying, cooling down, and delivering oleaginous and fatty matters, or other material treated by steam pressure for extraction.*

The patentee claims the use or application, in the treatment of fatty or oleaginous matters, or for other similar purposes, of a closed steam-tight vessel or digestor, in combination with a receiver or second vessel for the purposes of treating, that is to say, smelting, purifying, and drawing off under pressure the fluid portions of such matters for the objects and purposes described. 2, The use and application in the treatment of the aforesaid matters and like purposes, in combination with a digestor or other similar vessels of a steam-tight receiver, or second vessel, as a recipient for the fluid portions of the aforesaid matters heated under pressure, for the purpose of allowing the same to cool down to the temperature at which they may, without injury, be exposed to the atmosphere for the reasons and purposes drscribed. 3, The use and application of a jointed or moveable pipe, with or without a strainer, rendered buoyant by a float or otherwise, and having its outlet at the lower part of the vessel to which it may be attached, for the purpose of drawing off the supernatant fluid contents of the vessel or vessels. 4, The application of the drying apparatus, as described, for the purposes specified. *Patent completed.*

1663. J. WHITWORTH. *Improvements in shells.* Dated June 2, 1862.

According to this invention shells are made of metal properly hardened. They are solid for a sufficient length in front of the internal cavity to give the requisite strength for penetration. The fuse usually employed for igniting the bursting charge is dispensed with, as the heat generated by the impact of the shell is sufficient to ignite the charge. To prevent the heat generated by impact from acting prematurely, and to regulate the time of ignition, the bursting charge is surrounded by a proper thickness of flannel or other material which is a non-conductor of heat. The body of the shell the patentee makes of the metal known as homogenous iron, or of very mild, lowly carbonized steel: the metal is by the makers of homogenous iron cast into an ingot, and hammered so as to produce a bar of suitable section. Having obtained such a bar, forged approximately to the form of the shells, he cuts it into lengths, each sufficient to form two shells: these lengths are then what is technically termed converted, so as to render the exterior part more highly carbonized, and therefore harder than the interior, to a depth of from a quarter to half an inch. These pieces he divides (and brings to the form shown in the drawing), boring them internally, and turning and cutting them externally. This being done, he puts the body of the shell into an iron box, and surrounds it with animal charcoal, cuttings of horn, and such like materials ordinarily employed in the process of case-hardening, and, as is usual in that process, he heats the box with the body of the shell within it to a red heat. He then withdraws it, still red hot, from the box, and having set it up on end, he causes numerous jets of cold water, by preference brine, to play both on its outer and inner surfaces, thus the shell body is rapidly cooled and rendered hard. In this state, however, it is more brittle than is desirable: this he obviates by tempering it, for which purpose he places it with its base on a block of metal heated to dull redness, and allows it to remain there until a straw colour at the front and a blue colour at the rear indicate that it is tempered to the proper degree *Patent completed.*

1664. W. E. NEWTON. *An improved mode of making the handles of shovels, spades, dung forks, and othera nalagous articles.* (A communication.) Dated June 2, 1862.

This consists in forming the eye of the handle by splitting or sawing in a horizontal direction, for a suitable distance, the end of the bar or shaft of which the wooden handle of this implement is composed, and then bending out into the form of a fork the parts formed by the split or key. The holder is then secured between the ends of the fork in any convenient way, and the parts are held together by a tie rod with screwed ends. *Patent completed.*

1665. E. LLOYD. *Improvements in machinery for the manufacture of paper.* Dated June 2, 1862.

The patentee claims—1, Operating in the manner set forth upon vegetable fibres, preparatory to converting them into pulp for the manufacture of paper, in a close vessel or boiler, either fixed or moveable, and provided with a perforated false bottom or lining, and into which boiler or close vessel steam, water, or air is or are admitted for the purposes set forth. 2, Lining the sides and bottom of the bleaching, poaching, and beating vessels, with perforated metal, so that the liquor may be drawn off without removing the fibres. 3, Countersinking the holes made in the perforated metal employed in the bleaching, poaching, or beating vessel, and also in the close vessel or boiler, as described. Lastly, adapting to the delivery end of the paper-making machine a shifting or movable table to receive the paper as it is delivered from the machine, as and for the purpose set forth.—*Patent completed.*

1666. A. V. NEWTON. *Improved machinery for breaking and cleaning flax and other like fibre-yielding plants.* (A communication.) Dated June 2, 1862.

This invention is not described apart from the drawings. *Patent completed*

1667. J. MARSON. *A new or improved projectile for small arms and ordnance of every description.* Dated June 2, 1862.

These projectiles are well adapted for smooth bores, because they rotate of themselves, by being propelled through the air; and this object is attained by making the projectile with helical, or winding passages, around its axis. The centre of the axis may be solid or concave, but the inventor prefers the cavity of the form of the exterior, which exterior he sometimes makes of a parallel or cylindrical body, and conical apex or point, the base being flat. *Patent abandoned.*

1668. J. H. GEBHARDT. *An improved fastening for bags, purses, and other similar articles.* (A communication.) Dated June 2, 1862.

This consists of an improved fastening, in which is a lever, so arranged that, when depressed at one end, it depresses a spring placed beneath it, and thereby releases from each other the two engaging parts of the fastening, but when the lever is released or restored to its previous position it allows the spring to rise, and the engaging parts of the fastening (supposing them placed together) to be again engaged. The lever is worked from outside the bag, &c., by a handle, finger-piece or end, on raising which, or moving it in an upward direction, the opposite, or inner, end of the bar is depressed, the spring forced down, and the fastening opened. *Patent completed.*

1669. T. L. SCOWEN. *The ocular demonstrater of time in music and accentor.* Dated June 3, 1862.

This consists in having spaces marked on a dial or tube, the dial representing different length bars in music equally divided, and hands, or pointers worked by clock work, pass at an equal rate from left to right successively, which will show the exact time each of the various length notes or rests is to be held, or continued, and a hammer with such arrangements as to cause it to give a louder beat at the executed parts of different bars. The accent is indicated or produced by the higher teeth in a star framed wheel; the whole is set in motion by a train of wheels with spring barrel or weight, and regulated to the different degrees of quickness or slowness by an expanding fly. *Patent abandoned.*

1670. C. GURNEY. *Improvements in apparatus for production and application of artificial light.* Dated June 3, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1671. W. H. HALL. *Improvements in miners' safety lamps.* Dated June 3, 1862.

This consists in the manufacture of the Davy or safety lamp with a spring lock, and superior wire gauge. The superior wire gauge is made by forming the woven wire-work into the usual or suitable shapes, and then tinning or galvanizing them; this process solders the seam and strengthens them entirely. *Patent abandoned.*

1673. J. BIERS. *Improvements in shoes for horses and other animals.* Dated June 3, 1862.

For the purposes of this invention in making shoes, the under surfaces are formed with projections at intervals apart, there being spaces between the neighbouring projections. This part of the construction does not materially differ from what has before been done in the making of some kinds of shoes, but according to this invention, in place of the upper surfaces of shoes being as heretofore when they have been made with projections or roughings on their under sides, they are, according to these improvements, made with indents or cavities opposite where the projections are produced on the under sides, so that the projections are hollow on the upper surfaces of the shoes, thus forming undulations or corrugations, by which means shoes are made extremely strong, and at the same time comparatively light. In order to fasten such shoes to the feet of horses and other animals, the outer edges of the upper surface of a shoe are made to fit as heretofore against the under surface of the outer edges of the hoof. For this purpose the undulations or corrugations of the metal do not proceed to the outer edges of a shoe, but stop short, so as to leave a sufficient width to fit against a hoof, and to receive the nails. *Patent completed.*

1674. S. WESTON. *Improvements in trusses.* Dated June 3, 1862.

In carrying out this invention the pad is mounted on and carried by a metal disc or plate, which has two studs or projections thereon, which enter through holes in the back of the pad. On either side of these studs or projections is a half elliptical spring, which is fixed to the disc or plate so that the ends of the springs rest against and press the pad outwards, yet allow of its moving on the projections or studs in any direction. On the disc or plate is attached one end of a bent wire or rod, by means of a pin joint, so that it is capable of movement. This bent wire or rod ascends up nearly to the hip. At the other end of this wire or rod there is a hook or other means of attaching it to a strap, which passes over the hip and behind the back of the person who is wearing the truss. The other end of this strap is then passed over the other hip, and is attached to the end of another wire or rod, which is, by its other end, fixed to the disc or plate, and ascends some distance from the disc up towards the hip last mentioned. One end of a second strap is attached to the end of another wire or rod, which is also attached to the disc or plate, and descends some distance below it. This strap passes between the legs of the person wearing the truss, and then ascends up behind the person in an inclined direction, and is made fast to the other strap near where it passes over the hip last mentioned. *Patent completed.*

1675. J. L. NORTON. *Improvements in machinery for raising and forcing water.* Dated, June 3, 1862.

This invention is applicable to pumps where diagrams or flexible partitions are employed, as well as to other forms of pumps, and consists in applying the suction or induction pipes or inlet at the upper part of the cylinder or chamber of a pump, within which the piston or diaphragm works, so that the cylinder, or chamber of the pump, is at all times charged with water, even though the pumps be defective; and, further, in combining with pumps, whether they be double or single-acting, a peculiar arrangement of valves. For this purpose the inlet and outlet valves are placed at, or above, the upper parts of the cylinders, or chambers of the pumps, and the outlet valves are arranged above the inlet valves, which are placed in suitable boxes, or compartments, exterior of the cylinders, or chambers, of the pumps, but connected with them by suitable passages to admit of the valves being readily got at. The inlet and outlet valves are arranged over the upper ends of the suction pipes of the pumps. *Patent completed.*

1676. J. FINCHAM. *An arrangement, or arrangements, of mechanism useful for facilitating the repairing of roads and ways; also applicable to the tilling of land.* Dated June 3, 1862.

In carrying out this invention a frame is constructed composed of bars of iron, or other metal or material, the said frame having the form of a square, or other convenient figure, such frame being provided with guides for the purposes hereafter described, the whole being mounted upon wheels (three being the number preferred), the axle of the front wheels forming part of, or being properly secured to, the said frame, and the hinder wheel being secured as hereafter described. To the front part of the above-named frame is attached (as hereafter described) the after-mentioned rake arrangements, and nearer to the back, or handle, part of the machine than to the rake, there are arrangements of scrapers provided to follow the said rake when in use, and scrape together the stones, roadstuff, and the like. To make the connection between the said rake arrangements and the frame aforesaid, long pairs, or slide bars, are used, which work in the guides above-mentioned, these guides crossing one another at right angles, or nearly so, by which arrangements the said scrapers may (within the limits of the guides) be moved to a greater or less angle, as may be required, scraping the filth from off the roads, by allowing the angle of the scrapers to be reversed for levelling the roads. The said pins, or slide bars, are provided with such screws, nuts, or heads as shall keep the scraper arrangements steady and secured to the frame aforesaid, but with capability of travelling on the guides when desired. Handles, or levers, are attached to the said scraper arrangements for lifting and also for pressing the same down upon the road. For tilling land, the scraper arrangements and the rake arrangement can, if required, be removed, and agricultural hoes, rakes, harrows, or scarifiers, be substituted in the place of the rake aforesaid, and thus this machine may be rendered also appreciable to the tilling of land. *Patent completed.*

1677. A. H. PERRY. *Improvements in fastenings for and in the method of fastening together, or securing railway chairs and sleepers, and for other similar purposes.* Dated June 4, 1862.

Instead of employing the ordinary solid or compressed wooden trenails alone, and instead of using iron spikes of any convenient shape or form alone, for securing iron chairs to the wooden sleepers of railways, as is now commonly practised, the patentee forms a hollow or tubular wooden trenail, and uses in combination therewith a novel shaped metal spike. He takes a wooden trenail either turned parallel with a head or shoulder, or with any suitable amount of taper, and he bores a hole along its axis; he also takes an iron spike or round metal pin, with a head, and he flattens it at some distance above the point, but he prefers to leave the point cylindrical, so that there is a square shoulder formed on two sides by the flattening. For the purpose of fastening iron chairs on wooden sleepers he first bores the sleeper or other substance, and then drives the hollow wooden trenail through the hole in the chair and into the wooden sleeper to the required extent; he then drives the novel description of spike or pin into the hollow trenail, which is thereby expanded at its lower end, and thus forms a dovetail within the wood, which will prevent the trenail from being withdrawn from the sleeper, as also the spike or pin from being withdrawn out of the trenail. *Patent completed.*

1678. G. PEEL, and J. SIMPSON. *Improvements in the construction, arrangement, and mode of working hydraulic presses.* Dated June 4, 1862.

These improvements in the construction of hydraulic presses consist in making the cylinders and rams of steel, instead of cast-iron, as heretofore customary, in making the columns of steel instead of wrought-iron, and in making the framing for the top and bottom of the press of wrought-iron or steel, either alone or combined with cast-iron or other materials, instead of entirely of cast-iron, the object being to unite great strength with comparative lightness. The improvement in the arrangement of hydraulic presses consists in making the rams and cylinders to work within each other, in the same manner as the slides of a telescope; the largest ram works within a stationary cylinder, and the smaller ram works within the larger ram, which acts as a cylinder, and in this way two or more rams of different diameters may be acted upon successively to increase the power of the press as the speed diminishes. When the smaller or smallest ram has been raised, self-acting blocks come into action to support the follower, which is then carried forward by the action of the succeeding ram. The improvement in the mode of working hydraulic presses consists in forcing the water that has been used to raise the ram or rams into an air vessel in which it accumulates under pressure, and in conveying this water again into the cylinder or cylinders of the press for the purpose of partially raising the ram or rams during the next operation. By this means the rams are rapidly raised, while the pressure to be overcome is small, thus economizing power and time in working the hydraulic press. The air vessel may be charged direct by the pumps when the pumps are not required for working the press. The improved arrangement of force pumps for hydraulic presses consists in connecting the plungers of two or more pumps to a beam working on a fulcrum, the piston-rod of a steam cylinder direct to one or both ends of the beam, thereby applying the power in the most convenient manner for working any convenient number of force pumps. The pumps are, or may be, of different diameters, and they are provided with self-acting valves, so that, as the resistance increases, the larger pumps are successively thrown out of action. *Patent completed.*

1679. C. S. CAHILL. *Improvements in the manufacture of felted fabrics suitable for hats, bonnets, and other purposes.* Dated June 4, 1862.

The first part of this invention consists in preparing such felted fabrics by taking a body, foundation, or form of suitable shape made of paper, paper pulp, calico, linen, or other woven fabric, and applying to it a coating of varnish, shellac, india-rubber in solution, size, glue, or other suitable adhesive material, upon which the inventor applies a sufficient quantity of ground or properly prepared flock, wool, silk, cotton, or other suitable fibrous material, which is then pressed and worked to a proper surface; and if not of sufficient substance, an additional coat or coats of the adhesive material may be applied, and additional quantities of the felting or other materials may be added. *Patent abandoned.*

1680. W. JAMES. *Improvements in bolts, spikes, and nails, and in apparatus for their manufacture.* Dated June 4, 1862.

This invention consists in making bolts, spikes, and nails, of round spiral-grooved rods, and in a peculiar apparatus for producing the twist in the rod during the process of manufacture. The metal rods, of which these articles are manufactured, are first rolled with one or more straight grooves or channels. To give the required spiral direction to the grooves or channels, the rods are afterwards twisted, and, finally, the bolts, spikes, or nails, are headed in the usual manner. For the purpose of producing the twist in the metal rod, a simple box or cylinder is used, with a perforation slightly larger than the rod itself, on which perforaon spiral protections are formed equal in number to the grooves on the rod, and varying in size and form according to the size and desired curvation of the grooves or chambers in the finished articles. The metal rod coming from the rollers passes into and is forced through the said box or cylinder, thereby twisting the rod more or less, the degree of twist depending upon the form of construction employed for the inside of the box or cylinder. This twist or spiral form, however, may be given, though not so conveniently, by the ordinary means to each length separately, either before or after the bolt, spike, or nail is headed. When one of these bolts, spikes, or nails is driven into a hole somewhat smaller than the said bolt, spike, or nail, it passes through spirally or in a manner similar to that of a screw, and it retains its position with a much greater tenacity than the ordinary bolt, spike, or screw. *Patent completed*

1681. J. Allcock. *Improvements in the construction of horse rakes.* Dated June 4, 1862.

This invention consists, 1, In placing a boss on the inner side of the machine at each end thereof, and in bringing this boss nearly throughout its length, but leaving its inner end closed. In this bored boss the patentee fits a turned axle, and the other end of the axle he inserts and secures in the nave of the wheel. He also cuts a groove round that end of the axle which is placed in the boss, and passes a set screw through the boss, the end of this screw taking into the groove, and thereby securing the axle fast into the boss, but leaving it (the axle) free to revolve. The improvements next consist in the following improved mode of altering or varying the pitch of the teeth. For this purpose he places two or more transverse bars in the machine, upon each of which bars he places a clip: these clips embrace the bars, and have a series of holes in them, through which he passes spring cotters, the cotters also passing through holes in the transverse bars, that is to say, each cotter passes through one of the holes in one of the clips, and through a hole in the transverse bar embraced by such clip. The lever bar on which the teeth of the rake rest lies on the top of clips, so that the pitch of the teeth is regulated by the height at which the clips are placed and secured on the bars. The teeth can thus be set either to touch the ground, or just to clear it, or they may be raised up to the highest point required. There is attached to the machine a presser bar, which works on the top side of the teeth, for the purpose of making the teeth hold closer to their work. *Patent completed.*

1682. R. Roe. *Improvements in planes for tongueing, working sash fillisters, or other similar purposes.* Dated June 4, 1862.

The object of this invention is to supersede the necessity for the numerous planes required by a carpenter or joiner for preparing the tongues used in the various operations of carpentry, and for the purpose of carrying out these improvements, the inventor makes the plane with an adjustable fence, similar to those used in a "plough" or "side fillister plane," having two planes similar to those known as rabbet planes, working on a bar, so as to keep them perfectly parallel and true with one another. These planes are also provided with a "stop" which regulates the depth to which the tongue shall be cut, and they are provided with suitable adjusting and set screws, so as to enable the workman to make the tongue of any desired width, depth, or position, on the plank or other piece of wood operated upon. *Patent abandoned.*

1683. G. Allibon and E. Snell. *Improvements in surface condensers and superheaters.* Dated June 4, 1862.

This invention relates to the construction of tubulous vessels, in which the steam or vapour to be cooled or condensed, or superheated, or charged with additional degrees of heat, as the case may be, is made to pass from one chamber or passage, by means of a bent tube, into another chamber or passage—the cooling or heating, or the heat abstracting or superheating (as the case may be), being effected within the main casing, and through the external surfaces of the bent tubes. The apparatus may consist of a vessel divided into two parts by a tube-plate, in which the two ends of each of the bent tubes are secured, the larger portion of the chamber being occupied by the tubes, and the smaller portion being occupied by a number of divisions or plates forming chambers or passage ways, alternately arranged for the in-going or out-coming of the steam, which is made to pass through the legs of each of the bent pipes. Or, instead of the apparatus being formed of one vessel only, the tubulous portion may be one vessel, and the divisional or cellular portion for the inward and the outward passage of the steam may be another vessel, and these two may be bolted together, or otherwise connected. For surface condensers, the patentees prefer to make the case, or external shell, of cast iron, although it may be constructed of any other metal—and where horizontal layers of bent tubes are preferred, the front and back of the condenser should each be enclosed or secured by a perfectly air-tight cover, so that ready access may, when necessary, be had to the interior. Each of the passage ways devoted to the exhaust should be connected with a bottom chamber or general receiver for the condensed water, whilst the steam passages are in the like manner connected together from the steam exhaust pipe. The bent ends of the pipes, which are free to expand and contract, may be supported either on bearing pieces cast with the back cover, or they may be supported on bearing bars or independent bearers arranged within the case. The two ends of each bent pipe being secured in the same tube-plate, in each case the one leg communicates with the steam passage or chamber, and the other leg with the exhaust or condensor, the bent tubes being one above the other: for each set of vertical passages the number of vertical series may be increased, according to the space which can be afforded to the width of the condenser, and according to the condensing surface or area required. For superheaters they prefer to employ an apparatus generally similar to that described as intended for the condensation of steam, although the proportions, as well as the details of the arrangement, should be varied to render it more suitabte for the special purpose and the position of the application; but generally they prefer to add an exterior casing surrounding the shell, within which the heating operation is performed, and within which interior shell is contained the bent tubes through which the steam to be superheased is made to pass. *Patent completed.*

1684. G. B. Toselli. *Improvements in apparatus for freezing and cooling liquids.* Dated June 4, 1862.

This invention consists in arranging an apparatus so as to give it a horizontal rotary motion, in order that the refrigerating compound shall receive a vertical motion, so that it shall act quietly and efficaciously, and also to change continually the positions of the liquids to be congealed for the purpose of disengaging the air. *Patent completed.*

1685. J. and G. Battinson. *Improvements in machinery for combing wool and other fibres.* Dated June 4, 1862.

In carrying out this invention the inventors make the combs and lifters straight, except the front ones, or those next to the circular comb, filling up the angles or spaces betwixt the straight and curved ones at each end by short rows of combs or teeth and lifters. By this means they can produce better work and in greater quantity than heretofore. *Patent abandoned.*

1686. G. H. Sanborn. *Improvements in refrigerators.* (A communication.) Dated June 4, 1862.

These refrigerators are constructed of any desired form and size. The materials found most suitable for this purpose are galvanised iron or zinc. In the top of the said refrigerator is an ice chamber, and between the exterior wall and the interior wall there is a space designed for cold air and ice-water, extending round the vessel, except that part occupied by the door. The water is drawn from this space in the usual manner. The inventor employs the cylindrical form, which is the most convenient and otherwise desirable. The shelves rest on supports fixed to the interior wall, and on the bottom is placed a table, constructed to revolve for convenience of access to the contents of the refrigerator. *Patent completed.*

1687. F. P. Preston and C. Goodman. *Improvements in the permanent way of railways.* Dated June 4, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

1688. E. Scheutz. *Improvements in rotary engines.* Dated June 4, 1862.

This invention relates to a previous patent dated 30th Oct., 1860 (No. 2656), and consists in so constructing such engines as to enable them to be worked expansively if desired. For this purpose a steam port is made to open into one end of the cylinder at the side thereof, communicating with the valve chest and another port communicating with the former one and the steam pipe; and the end of the piston at that part has a number of chambers or recesses formed in the surface thereof, such chambers or recesses being made to travel in front of the steam ports above referred to, and, consequently, they alternately open and close the communication between those ports, thereby cutting off the steam at any previously determined part of the revolution of the piston. A direct steam communication is also made with the valve chest, and a cock or valve is fitted therein, so that the steam may either be led at once to the valve chest by opening the cock, or the cock may be closed and steam diverted through the separate passage, and through the steam ports above referred to, in which latter case the engine will work expansively. *Patent completed.*

1689. S. Huston. *Improvements in safety valves.* Dated June 4, 1862.

For the purposes of this invention two valves are used on the same spindle or stem, one being of larger diameter than the other, and the steam is caused to act in such manner as to pass one towards its seat and the other off its seat. The spindle or stem of the two valves is hollow from the upper end thereof to nearly the lower end thereof, in order that it may receive a short rod, which is pin jointed to the weighted lever, by which the valves are pressed into their respective seats. Below the seat of the lower valve is a pipe, by which the steam which escapes from under the lower valve is conducted away, and, if desired, the steam passing the upper valve may also be conducted away by a pipe, or it may be allowed to escape directiy into the outer atmosphere. By these arrangements the steam in a boiler is constantly tending to open the valve having the larger area, while the steam is tending to close the valve, having the smaller area, and the weighted lever is constantly tending to press both the valves to their seats. *Patent abandoned.*

1690. A. V. Newton. *Improvements in the construction of grain and grass harvesters.* (A communication.) Dated June 4, 1862.

This invention has for its object to make a grain and grass harvester, capable in its general construction, and in its operation, of being changed from a grass mower into a grain reaper, and *vice versa*, and yet perform effectually the functions due to each operation, which differ in some material points. Thus, for instance, in cutting grass, the cutting apparatus must run close to the ground, and receive all its rising and falling motions from the ground over which it (the cutting apparatus) passes, and uninfluenced by the inequalities of the ground over which the driving or supporting wheel (or wheels) passes. In cutting grain, the cutting apparatus must be set up above the ground at a suitable height, and be there maintained, in a firm, rigid manner, but so that it may be raised to pass any intervening obstruction, or adjusted from time to time, as circumstances may require. For one purpose, therefore, the cutter, or finger bar, must be flexible, and follow the undulations of the ground over which it passes, but under the control of the operator tending the machine, and for the other it must be rigid, and be carried, at a fixed distance, above the ground, uninfluenced, certainly, by the ground over which the driving or supporting wheel (or wheels) passes; but, when mowing grass, it is always under the control of the operater, who rides upon the machine, and, with a lever, or its equivalent, governs the cutting apparatus as to height, and raises it over any obstruction in its path. The invention cannot be described in detail without reference to the drawings. *Patent abandoned.*

1691. E. Conroy. *Improved machinery for cutting corks, bungs, and such like articles.* Dated June 4, 1862.

This invention relates to various improvements upon a machine for cutting corks and bungs, for which letters patent were granted to Alfred Vincent Newton, dated the 18th day of June, 1859, and consists in cutting pieces of cork, that have been previously prepared, of suitable dimensions, or, as they are termed, "quarters," into cylindrical or conical corks or bungs, by means of a rotating circular disc cutter, or plate. The frame, or shaft, which carries this revolving disc, or cutter plate, has an upward and downward motion communicated to it when required. These motions are governed by a cam, mounted upon the main shaft, and the object of this arrangement is to enable the rotating disc, or cutter, to make two distinct cuts on the same piece of cork. One of these cuts will simply cut off the rough sides and angles of the "quarter," and the other will make a finer and finishing cut, which will complete the cork. Both of these cuts are effected during two revolutions of the "quarter" between the suspending or holding pivots. Another improvement in this machine consists in giving to the clamps, or pivots (used in holding the "quarters" to be cut or rounded), and also to the sliding feeder, considerable facilities for self-adjustment, should any variation occur in the length of the cork, or "quarter," to be cut. The clamps, or pivots, or the pivot and tube between which the block, or "quarter," to be cut is held, are both mounted with helical or other springs, and the face of the feeder is made capable of a slight lateral adjustment by means of a spring slide, thus avoiding the probability of compressing the cork more than is necessary to hold it during the process of cutting or rounding. *Patent completed.*

1692. G. Rydill. *An improved hydraulic pump, or engine, for raising liquids and obtaining motive power, also applicable for the ventilation of mines, and other useful purposes.* Dated June 5, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1693. J. E. Moiroux. *A new compound for protecting and preserving the polish, polished, and other surfaces of metals, woods, skins, and paper, and for rendering all woven textile and other fabrics water and weather-proof.* Dated June 5, 1862.

This compound, or liquid, is produced by the chemical action of acids, water, and ether in the quintessence of alcohol upon silk, cotton, or other vegetable matter, by which the latter is decomposed, dissolved, and converted into a liquid state, so as to combine or mix with the rectified spirit, and form a limpid transparent gum or compound possessing the properties above-mentioned. The liquid may be used with colour without losing its properties. *Patent abandoned.*

1694. J. Bell. *Improvements in fastenings for railway chairs.* Dated June 5, 1862.

This invention relates to improved metallic spikes to be substituted for the trenails, or fastenings, by which railway chairs are ordinarily secured upon their sleepers. According to one modification, the improved metallic spike is made of a piece of sheet, or malleable iron or steel, which is bent, or shaped, in dies or moulds, or by means of any other suitable tools that may be in use for like operations, into a tubular form. In this modification the edges of the metal are not brought quite close together, but are left slightly apart, so that the spike may be slightly compressed on being driven home, and its consequent tendency to re-expand will give it a firmer hold in the sleeper. With this view the hole in the sleeper is made a very tight fit for the spike, or even of a slightly less diameter than the uncompressed spike, and the point of the spike is slightly coned, or sharpened, as shown, to facilitate its introduction. *Patent completed.*

1695. R. Robinson. *Improvements in fire-escapes, parts of which improvements are also applicable to other purposes.* Dated June 5, 1862.

This invention consists essentially in constructing a portable machine, consisting of a base, or platform, provided with suitable wheels to allow of the platform and apparatus mounted thereupon being easily and rapidly moved about, or transported from place to place, and in applying to this portable base or platform a series of short ladders, which are elevated by specially arranged gearing, such ladders being guided in their ascent and descent by side guides. The invention also comprises arrangements for working the cage, or basket, intended for the occupant of a burning building. *Patent abandoned.*

1696. J. M. Stanley and J. Stanley. *Improvements in stoves or apparatus for diffusing heat.* Dated June 5, 1862.

This apparatus consists of a fire-box cast in one piece, or in sections, fitted together, the length being about equal to four times its width. This fire-box is raised from the floor upon a hollow pedestal projecting more or less beyond it on every side. The sides of this pedestal are perforated, and in the top thereof a number of apertures are formed, through which perforations or apertures the cold air to be heated enters, and passes through the heated tubes hereafter described. In an opening in the centre of the pedestal a set of fire bars formed to the shape of the fire-box are fitted, and under these bars a sliding ashpit, which draws out at the end, is also fitted; this sliding draw or ash pit encloses the entire area of the grate, but does not project to any considerable extent therefrom more than is sufficient to cover the bar space and regulate the draft thereto. The draw or moveable ash pit is fitted with a valve at the end for regulating the flow of the air to the fire bars, which are cut off from the surrounding atmosphere, or very nearly so, when the slide is closed. The fire-box is closed at the top by a metal arch or roof, by which the products of combustion are conducted to an aperture at the extreme end thereof. Through this aperture they are allowed to pass and return under a second arch or roof, and over the first to a second aperture at the opposite end of the second roof or metal arch, and are again conducted to a third aperture over the first, passing over the second arch and under the covering plate of the stove to an ascending or descending flue therein, by which the smoke and other products of combustion are carried off, and are thus effectually prevented from coming in contact with the surrounding atmosphere of the room or building, the latter being warmed by heat diffused by the circulation of the air through the apertures and tubular passages surrounding the fire-box and traversing the heated chambers of the apparatus. The air which enters the perforated pedestal before described is prevented from passing through the fire grate by the enclosed sliding ash pit, and is conducted from the lower to the upper part of the apparatus through a number of vertical cells or tubes which entirely surround, and are heated by, the fire in the fire-box. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Sept. 1, 1862.

2419. J. Watt, 13, Graham-street, Walworth, chemist, and T. S. Haviside, 69, Cornhill. An improved method of treating flax and other similar vegetable fibrous substances to be used as substitutes for cotton.

Dated Sept. 3, 1862.

2436. F. C. Bakewell, 6, Haverstock-terrace, Hampstead. Improvements in fire-places and stoves. A communication.

Dated Sept. 4, 1862.

2447. J. Platt, Oldham, and W. Richardson, mechanical engineers. Improvements applicable to the burning of bricks, tiles, and other articles of earthenware.

2450. J. Platt, Oldham, and W. Richardson, mechanical engineers. Improvements in the preparation of clay for the manufacture of bricks, tiles, and other articles which may be made of such material.

Dated Oct. 15, 1862.

2777. W. Wilson, 18a, Wigmore-street. An improved oblong drawing room bagatelle and billiard table, with reversible top, and made in various shapes and sizes.

Dated Oct. 16, 1862.

2791. G. Berry, 19, Buttesland-street, Hoxton, gentleman. Improvements in locks.

Dated Oct. 25, 1862.

2874. G. T. Key, Lieutenant in her Majesty's Royal Navy, Portsmouth. Improvements in fog and other signals.

Dated Oct. 27, 1862.

2893. G. Lindemann, Salford, engineer. Improvements in the manufacture of bricks, tiles, slabs, and other articles of earthenware or other plastic material, and in the machinery or apparatus connected therewith.

Dated Oct. 31, 1862.

2947. H. Williams and J. Maxton, Broadway, Nottingham, lace manufacturers. Improvements in machinery or apparatus employed in the manufacture of lace or trimmings made on bobbin net or twist lace machines.

Dated Nov. 3, 1862.

2969. W. Clark, 53, Chancery-lane, engineer. Improvements in castors, and in the manufacture of the same. (A communication.)

Dated Nov. 19, 1862.

3105. J. Chalmers, 8, Knight's-place, Vauxhall. Improvements in the use, combination, and application of iron and timber as armour for vessels of war and fortifications.

Dated Nov. 24, 1862.

3151. R. and W. Hawthorn, engineers. Improvements in pump valves.

Dated Nov. 27, 1862.

3176. J. Halford, Great Barr, Stafford, coke burner. Improvements in the preparation and treatment of small coal or slack, whereby a certain carbonaceous product is obtained and rendered available for use in the manufacture of iron and steel in the processes of casting and moulding metals, and in the manufacture of paint and such like articles.

Dated Nov. 28, 1862.

3197. A. Dudgeon, 19, Cullum-street, City, steam ship furnisher. Improvements in packing for various parts of steam and other engines and machinery.

Dated Dec. 1, 1862.

3218. J. Coppard, Hoxton. An appliance or appliances for horse shoes, to produce the effect of what is termed roughing.

3223. B. Oldfield, Coventry, machinist. Improvements in looms.

Dated Dec. 4, 1862.

3249. H. Swan, Bishopsgate-street Without. Improvements in stereoscopic apparatus.

3251. R. D. Kay, Accrington, manufacturer of patent fabrics. Improvements in the manufacture or finishing of endless machine blankets, or endless lappings for printing purposes.

3253. F. D. Delf, Liverpool, chemist, and T. C. Gibson, Ramsey, gentleman. Improved means and apparatus, whereby petroleum and other oils and hydro-carbons can be safely carried and stored.

3255. H. Castelbon, 15, Passage des Petites Ecuries, Paris. An improved press to be used in the manufacture of tiles and bricks. (A communication).

3257. J. Biggs, J. Johnson, T. Richardson, and T. Arnold, Leicester. Improvements in the manufacture of warp fabrics.

3259. R. Hornsby, jun., Spittlegate Iron Works, Grantham. Improvements in apparatus for cutting and pulping turnips and other vegetables.

Dated Dec. 5, 1862.

3261. M. Tildesley, Willenhall, Stafford, lock manufacturer, and E. Sharpe, Swadlincote, Derby, earthenware manufacturer. Improvements in the manufacture of earthenware knobs, and in fixing them in spindles used with certain kinds of knobs, in securing the metal mounts upon such knobs, and in apparatus to be employed in certain parts of this manufacture.

3262. L. Christoph, Paris, W. Hawksworth, Linlithgow, North Britain, steel manufacturer, and G. P. Harding, Paris, merchant. Improvements in drilling, drawing, and rolling metals, and in the machinery or apparatus employed therein.

3263. E. B. Wilson, Parliament-street, Westminster, engineer. Improvements in railway wheels, and in the mode of manufacturing the same.

3265. J. M. Rigby, Manchester, engineer. Improvements in presses for pressing cotton or other fibrous materials.

3267. W. J. Smith, Brooklands Cottage, Sale, Chester. Improvements in the manufacture of collars, cuffs, and wristbands.

3269. C. Galleti and F. Stefano, Charles street, Hoxton, cabinet makers. Improvements in articles of furniture.

Dated Dec. 6, 1862.

3271. R. Thorp, Liverpool, engine-tender. Improved coating or covering for steam boilers and other surfaces to prevent the radiation of heat.

3273. G. Wright, Friern Manor, Peckham Rye, farmer and cattle-food manufacturer. Certain improvements in the preparation and manufacture of food for cattle.

3275. J. Campbell, Belfast, flax spinner. Improvements in means or apparatus for heckling or hackling flax and other fibres.

3277. E. and W. Ullmer, Castle-street, printing machine manufacturers. Improvements in cylinder printing machines.

3281. W. Palliser, Captain, 18th Hussars, Dublin. Improvements in screw-bolts.

Dated Dec. 8, 1862.

3282. G. Lowry, Salford, machinist. Improvements in machinery for hackling flax, and preparing to be spun flax, hemp, tow, and such like materials.

3283. J. L. Budden, Fenchurch-street, merchant. Improvements in means or apparatus for obtaining and applying motive power for propelling or other purposes. (A communication.)

3284. J. Sellars, Pendlebury, near Manchester, manufacturing chemist. Improvements in the manufacture of pulp or half stuff used in the manufacture of paper, pasteboard, and similar articles.

3285. P. Todd, Wheelton, Lancashire, spinner and manufacturer. Certain improvements in pickers used in looms for weaving.

3287. G. A. Huddart, Brynkir, Carnarvon, gentleman. Improvements in buttons.

3289. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in preserving animal substances. (A communication.)

3293. J. A. and C. L. Kiesling, Liverpool, artists. Improved means of renewing worn out and partially worn out files and rasps.

3294. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the construction of steam generators. (A communication.)

Dated Dec. 9, 1862.

3295. T. Wingate, jun., engineer and iron ship builder, Glasgow. Improvements in dredging machinery.

3297. M. F. Benton, 121, Percy-street, Bedford-square, merchant. Improvements in the manufacture of gunpowder. (A communication.)

3299. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in treating liquorice root to obtatn liquid and solid extracts therefrom. (A communication.)

3301. J. Howard, J. Bullough, and T. Clegg, Accrington. Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.

3303. P. Effertz, Manchester, engineer. Improvements in machinery or apparatus for making bricks, tiles, drain pipes, and other similar articles.

3305. E. B. Wilson, 5, Parliament-street, Westminster, civil engineer. Improvements in machinery or apparatus for rolling metals.

Dated Dec. 10, 1862.

3306. J. Lamb, Holborn Paper Mills, Newcastle-under-Lyne, Stafford. Improvements in the manufacture of tissue paper for transferring patterns and designs.

3307. W. Inglis, Montreal, Canada, engineer. Improvements in steam boilers.

3309. J. R. C. Taunton, Birmingham, manufacturer. Improvements in the manufacture and ornamentation of metallic bedsteads, and other articles of like manufacture.

3311. M. Osborne, Birmingham, iron founder. Improvements in the manufacture of cast iron fenders.

3316. J. King, Heanor, Derby. Improvements in apparatus used for signalling on railways.

3317. E. Toynbee, Lincoln, analytical chemist. Improvements in extracting oils and fatty matters from shoddy, or refuse wool, skins, or skin pieces, glue pieces, cotton waste, and other animal or vegetable matter, and in producing an artifical manure.

Dated Dec. 11, 1862.

3319. W. Tristram, Halliwell, near Bolton-le-Moors, manufacturer, and H. Brereton, manager. Improvements in machinery or apparatus for sizing yarns and threads.

3321. R. A. Ronald, Glenpatrick, Renfrew, carpet manufacturer. Improvements in printing textile and felted fabrics, and in the machinery or apparatus to be used therein.

3323. A. W. Burgess, 107, Strand. Improvements in the preparation of anchovies.

3325. W. Goulding, 17, Margaret-street, Leicester. Improvements in ploughs.

Dated Dec. 12, 1862.

3327. G. Winiwarter, 32, King-street, Cheapside. Improvements in the construction of portable houses, walls, or partitions of buildings, strong rooms, safes, refrigerators, reservoirs, piers, and other structures: also applicable to the construction of casks and similar articles, boats, and ships.

3328. H. Sanderson, Sheffield, table knife maker. Improvements in the manufacture of table and other knives and forks.

3331. C. Hancock, West-street, Smithfield, and S. W. Silver, 4, Bishopgate-street, City, manufacturers. Certain compounds and substances applicable for electric insulation and other purposes.

3333. G. Clark, 30, Craven-street, Strand. Improvements in fortification for the defence of ships, batteries, and forts.

3334. S. Fox, Stockbridge Works, Deepcar, near Sheffield. Improvements in retorts and apparatus employed for the manufacture of gas, and also in purifying gas.

Dated Dec. 13, 1862.

3335. J. Brown, Atlas Steel Spring and Iron Works, Sheffield. Improvements in the manufacture of armour plates.

3336. J. W. Baker, Bury, cotton spinner. Improvements in machinery or apparatus for spinning cotton and other fibrous materials.

3337. J. Brown, 23, Sidney-street, Commercial-road East, engineer. Improvements in hydraulic machinery.

3338. E. Thorold, Lee. Improvements in drill braces, which improvements are also applicable to spanners.

3339. C. Corbet, 69, Upper Gardiner-street, Dublin, esquire. Improvements in rails for railways, and in the mode of forming the joints of the same.

3340. R. Aitken, Cambridge-street, Pimlico, civil engineer. Improvements in locomotive engines.

3341. J. Petrie, jun., Rochdale, ironmonger. Improvements in machinery or apparatus for washing wool and other fibrous materials.

3342. J. J. Thompson, Manchester, warehouseman. Improvements in machinery or apparatus for making pies and for cutting meat for the same.

3343. W. E. Newton, 66, Chancery-lane, civil engineer. An improved mode of, and apparatus for, repairing the rails, points, switches, and other parts of the permanent way of railways. (A communication.)

3344. M. Henry, 84, Fleet-street. Improvements in fitting or applying propellers to ships and other vessels. (A communication.)

Dated Dec. 15, 1862.

3346. W. Bestwick, Manchester, small-ware and braid manufacturer. Improvements in braiding machines.

3347. R. Stansfield, iron founder and machinist, and J. Dodgeon, mechanic, Todmorden, Lancaster. Improvements in looms for weaving.

3348. G. Buchanan, Bucklersbury. Improvements in machinery used in crushing sugar canes.

3349. W. Phelps, Nottingham, manager. Improvements in locks.

3351. E. B. Wilson, 5, Parliament-street, engineer. Improvements in machinery or apparatus for rolling metals.

3352. R. Kirk, Glasgow, North Britain, contractor. Improvements in machinery or apparatus for checking or stopping the motion of railway carriages.

Dated Dec. 16, 1862.

3353. J. McInnes, Liverpool, and E. F. Prentiss, Birkenhead. Improvements in the distillation and treatment of petroleum and other like oils to obtain products therefrom, and in the apparatus to be used therefore, parts of which can be applied for distilling other liquids.

3355. G. C. Warden, Islington, manufacturer. Improvements in ornamenting textile fabrics, leather, and other surfaces, in a cement employed therein, which is also applicable to the waterproofing of fabrics and materials, and in apparatus for applying and spreading such waterproofing cement. (A communication.)

3356. J. S. and S. Hancock, cutlers. Improvements in "anti-garotte" knives.

3359. W. and A. Smedley, Nottingham, tatting and lace manufacturers. Improvements in machinery or apparatus for the manufacture of textile or looped fabrics on warp lace machines.

3360. W. Hudson, Burnley, gentleman, H. Moore, cotton spinner, C. Catlow, overlooker, and S. Newburey, manager. Improvements in looms for weaving, and in arranging the warps therein.

3361. J. L. W. Thudichum, Kensington, doctor of medicine. Improvements in collecting human excreta, and in the apparatus and means employed therein.

3362. G. C. Wallich, M.D., retired list H.M.I. army, 17, Campden-hill-road, Kensington. Improvements in apparatus to be used in deep sea sounding for ascertaining the pressure and for raising specimens of the water.

Dated Dec. 17, 1862.

3365. R. Hattersley, Manchester, engineer. Improvements in apparatus for classing printers' types for composing machines.

3366. W. Tongue, Bradford, engineer. Improvements in machinery and processes for preparing fibrous materials.

3367. A. Albini, Birmingham, captain in the Italian navy. Improvements in breech-loading firearms.

3368. C. Defries, Houndsditch, manufacturer. Improvements in the manufacture or construction of lamps.

3369. T. Knowles, Ashton-nnder-Lyne, overlooker. Certain improvements in machinery or apparatus to be employed in preparing and spinning cotton and other fibrous substances.

3370. J. R. Hampson, Manchester, maker-up and packer. Certain improvements in the method of securing the extremities of the hoops or bands employed in packing bales, and in apparatus connected therewith.

3371. J. Thorne, Cardington-street, Hampstead-road. Improvements in apparatus for regulating the flow of gas to burners.

3372. J. Ramsbottom and G. Hacking, Accrington, machinists. Improvements in machinery or apparatus for measuring and registering the flow of water and other fluids.

3373. J. W. Hadwen, Kebroyd Mills, near Halifax, cotton spinner and manufacturer. Improvements in machinery or apparatus for spinning, twisting, and doubling cotton and other fibrous materials.

3377. R. Wheeler, High Wycombe, Buckingham, brewer. Improvements in ploughs.

3378. H. Burton, Princes-terrace, Prince of Wales-road, Kentish-town. Improvements in castors for furniture and other purposes.

3379. G. A. Huddart, Brynkir, Carnarvon, gentleman. Improvements in buttons.

3380. W. Clark, 53, Chancery-lane, engineer. Improvements in holders for lamps, candles, and other lights. (A communication.)

3381. C. J. L. Leffler, Gefle, Sweden. Improvements in constructing armour for ships and fortifications.

Dated Dec. 18, 1862.

3384. J. Clayton, Wolverhampton, furnace builder. Improvements in reverberatory furnaces for heating large masses of iron and steel, and in economizing the waste heat of the said furnaces.

3386. G. Russell, Glasgow, engineer. Improvements in cranes.

3388. J. and A. Brierley, Spa Mill, near Huddersfield, manufacturers. Improvements in carding engines.

3394. I. Holden, Bradford, machine wool comber. Improvements in means or apparatus employed in preparing and combing wool and other fibres.

3396. J. L. W. Thudichum, Kensington, Doctor of Medicine. Improvements in the preservation of beer and other fermented liquids, and in the apparatus and means to be employed therein.

INVENTIONS PROTECTED FOR SIX MONTHS BY A COMPLETE SPECIFICATION.

Dated Dec. 18, 1862.

3383. E. Lepainteur, Paris, manufacturer. Improvements in the fabrication of a salt for dyeing textile materials.

Dated Dec. 22, 1862.

3415. G. E. M. Gérard, Paris, manufacturer. Improvements in the fabrication of threads from vulcanized india-rubber, and the apparatus connected therewith.

Dated Dec. 23, 1862.

3422. F. Parker, Cambridge, carriage builder. Improvements in carriages.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2281. J. Irvine and J. W. Hand. Rifle rest.

2296. W. B. Herapath. Treating crystallizable sugar.

2302. T. F. Kirby. Garments.

2315. J. T. Oakley. Heating stoves.

2326. J. G. Tongue. Processes and apparatus for extracting the natural wax or fatty matters from wool, hair, or other animal or vegetable substances. (A communication.)

2329. H. Whittaker. Healds or heddles.

2334. S. J. Paris and W. Bate. Alphabetical electric telegraphs.

2335. J. C. Schemmann. Manufacture of steel.

2338. T. Clements, P. Llewellin, and J. W. James. Lubricating various parts of steam engines.

2341. S. F. Griffin. Distillation of petroleum, or any oleaginous, resinous, or alcoholic bodies.

2348. H. Twelvetrees. Washing powders.

2352. W. Carwood, W. Boaz, and C. Colwell. Propellers.

2360. W. E. Newton. Treating fermentable substances. (A communication.)

2365. G. Davies. Machines for washing skeins of cotton, linen, wool, or silk. (A communication.)

2370. A. Crichton. Weaving ornamental fabrics.

2371. G. Davies. Singeing woven fabrics. (A communication.

2375. W. H. Turner. Carding fibrous materials.

2379. R. A. Brooman. Separating or sorting and washing minerals. (A communication.)

2421. W. Clark. Obtaining light and heat. (A communication.)

2423. J. H. Johnson. Regulating or controlling the working of motive power engines. (A communication.)

2446. W. Clark. Colouring matter. (A communication.)

2455. J. S. Margetson. Manufacture of the material intended for scarfs or cravats.

2465. J. H. Johnson. Firearms and projectiles. (A communication.)

2476. A. J. Alderman. Ships' windlasses, capstans, and cable stoppers.

2486. M. Smith. Raising the nap on woven fabrics. (A communication.)

2491. G. Ritchie. Extracting the liquid portion of yeast, spent hops, or other similar matters.

2502. W. Clark. Cigar and cigarette cases. (A communication.)

2559. W. and J. Todd. Machinery or apparatus for collecting waste or fly from spinning machinery.

2609. W. Upfill and W. Ashbury. Metallic bedsteads.

2829. W. H. Tucker. Self-closing apparatus for doors.

3115. J. Jewsbury. Machines for raising weights.

3196. J. Adams and W. C. White. Boiling and evaporating.

3209. J. Anderson. Tyres of railway wheels, and rails, switches, and crossings of railways.

3259. R. Hornsby, jun. Cutting and pulping vegetables.

3276. J. Birchall and E. Borrows. Propellers.

3282. G. Lowry. Hackling flax, and preparing to be spun flax, hemp, and tow.

3323. A. W. Burgess. Preparation of anchovies.

3331. C. Hancock and S. W. Silver. Compounds and substances applicable for electric insulation.

3337. J. Brown. Hydraulic machinery.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed December 30, 1862.

1915. E. F. Prentiss.
1917. R. A. Brooman.
1918. C. Lungley.
1919. G. H. Birkbeck.
1920. J. Greenhalgh and J. Greenhalgh.
1926. J. James.
1929. T. L. Atkinson.
1930. G. H. Hulskamp.
1931. J. Murray.
1933. J. Crisp and J. W. Elliott.
1935. G. Bedson.
1936. J. M. Hetherington and T. Jackson.
1942. T. O. Dixon.
1945. W. J. Cunningham.
1946. A. Drevelle.
1948. J. Howard and J. Bullough.
1950. R. A. Brooman.
1952. C. G. Hill and W. Jackson.
1953. A. Warner
1954. P. B. O'Neill.
1960. W. Spence.
1985. H. Kellogg.
2002. C. E. and J. Green.
2147. A. Boyle and T. Warwick.
2209. M. A F. Mennons.
2316. W. E. Newton.
2536. E. Astel.
2612. M. A. F. Mennons.
2876. J. A. Nicholson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2920. G. F. Stidolph.
2953. X. C. and A. C. De Nabat.
2932. J. Giles.
2936. D. Hulett and G. Boccius.
2992. H. Cochrane.
2990. J. Whitworth.
2958. A. McDougall.
2967. S. King.
2969. J. S. Crosland.

1856.

90. A. C. Twentyman.
96. J. Goddard.

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2925. C. May and E. A. Cowper.
2950. T. Holmes.
2938. G. Chisholm.

1856.

117. J. Hamilton.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending January 2, 1862.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
1492	0	10	1506	2	4	1520	0	4	1534	1	10	1547	0	6	1560	0	8
1493	1	4	1507	0	6	1521	2	10	1535	0	8	1548	0	4	1561	0	4
1494	0	10	1508	0	4	1522	0	4	1536	0	4	1549	0	4	1562	0	10
1495	0	10	1509	0	10	1523	0	10	1537	0	4	1550	0	6	1563	0	4
1496	0	4	1510	0	4	1524	0	4	1538	0	4	1551	0	10	1564	0	4
1497	0	4	1511	0	4	1525	0	10	1539	1	6	1552	0	4	1565	0	4
1498	0	10	1512	0	4	1626	0	4	1540	0	4	1553	0	4	1566	0	10
1499	0	4	1513	0	4	1527	1	0	1541	0	8	1554	0	10	1567	0	4
1500	0	4	1514	0	4	1528	0	8	1542	0	4	1555	0	4	1568	0	4
1501	0	10	1515	0	4	1529	0	10	1543	0	8	1556	0	4	1569	1	4
1502	0	4	1516	0	4	1530	1	0	1544	1	0	1557	0	6	1570	1	4
1503	0	4	1517	0	8	1531	0	4	1545	0	4	1558	0	4	1571	0	4
1504	0	4	1518	0	8	1532	0	4	1546	0	4	1559	3	6	1572	0	6
1505	0	4	1519	1	4	1533	1	0									

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office.

TO CORRESPONDENTS.

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Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

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No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of his good faith.

RECEIVED.—J. N. and M. and W. (engaged), C. R. E., B. H. and Sons, "Ignoramus," "Galvani," C. A., B. N., J. J. L., L. Bros., C. D., R. H. and Co., J. H., W. R., T. W. S.

A. T.—No.

A CONSTANT SUBSCRIBER.—See notice at the head of this column.

L. S.—We go to press on Friday morning. Your parcel came too late to be availed of.

F. P.—You would do best to advertise.

T. C. (Leeds). The degree of LL.D. was, we believe, conferred on Mr. William Fairbairn, of Manchester, by the University of Cambridge. The two L's mean the two laws; viz., civil and ecclesiastical.

T. M. (Bolton).—It has been noticed before that a condensing engine has generally a worse vacuum in winter than in summer. At first sight the contrary would be expected, but the air is more *dense* during cold weather.

Fredk. SMITH (Manchester).—Captain Scott's system of rifling consists of three deep grooves, somewhat like the French "cannon range," but of a simpler shape, the incisions being taken more gradually. It has a twist of one-fortieth. It gave great accuracy of range. This gun, when tried in 1861, at Shoeburyness, burst after about 300 rounds.

PRICES CURRENT OF METALS.

London, Jan. 1. 1863.

		£	s.	d.		£	s.	d.	p.ct.
IRON:									
Welsh Bars, in London	per ton	6	15	0	to	7	0	0	2½
Nail Rods	,,	7	10	0	,,	7	15	0	,,
Hoops	,,	8	10	0	,,	9	0	0	,,
Sheets, single	,,	9	5	0	,,	9	10	0	,,
Staffordshire Bars	,,	7	15	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	6	0	0	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	13	9	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	0	0	0	2½
STEEL:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	10	0	,,	18	0	0	,,
COPPER:									
Sheet and Sheathing, and Bolts	,,	105	0	0	,,	0	0	0	3
Hammered Bottoms	,,	115	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	110	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	98	0	0	,,	0	0	0	,,
Tile Copper	,,	98	0	0	,,	0	0	0	,,
Best Selected	,,	101	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	11	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	9¼	,,	0	0	0	7½
Fine Foreign	per ton	98	0	0	,,	99	0	0	3
TIN:									
English Block	pr cwt.	115	0	0	,,	0	0	0	2½
Bar	"	116	0	0	,,	0	0	0	,,
Refined	,,	120	0	0	,,	0	0	0	,,
Banca	,,	119	0	0	,,	120	0	0	nett
Straits	,,	117	0	0	,,	118	0	0	,,
TIN PLATES:									
Best Charcoal, I.C.	pr box	1	9	0	,,	1	9	6	3
Second Quality	,,	1	7	0	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
LEAD:									
Pig, English	per ton	21	0	0	,,	22	0	0	2½
Spanish, Soft	,,	20	7	6	,,	20	10	0	,,
Shot, Patent	,,	23	10	0	,,	0	0	0	,,
Sheet	,,	21	10	0	,,	0	0	0	,,
White	,,	27	0	0	,,	27	10	0	,,
SPELTER:									
On the spot	,,	18	0	0	,,	0	0	0	nett
ZINC:									
English Sheet	,,	23	10	0	,,	24	0	0	2½
QUICKSILVER	pr btl.	7	0	0	,,	0	0	0	3
REGULUS OF ANTIMONY:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

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THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 9, 1863.

GUNS AND PROJECTILES.

It is to be regretted that in discussing the merits of different systems of guns and projectiles, a narrow spirit of partizanship too often prevails. In the reports of experiments, the essays of professional artillerists, the opinions published in periodicals, and even in the transactions of scientific societies, the preference of one system in opposition to all others, is unmistakeably betrayed by writers and speakers. A particular kind of gun or shot is extolled as the *ne plus ultra*, or a principle is advocated as the indispensable condition of success. The muzzle-loader and the breech-loader, the smooth bore and the rifled, the solid and the built up, the coil and the shrunk-ring, the cast iron, the homogeneous, and the steel, with endless varieties of rifling, and this or that mode of strengthening one or the other part, and the form and material of projectiles—are by turns made out to be essential requisites, just as it suits the interest of the particular inventor or gun-maker, whose system it is sought to recommend to public favour.

Hence it arises that notices of ordnance experiments, and the conclusions drawn from them, are, for the most part, covert puffs of a favourite system, or indirect attacks on its rivals. The cause of this objectionable personality of competition, which disregards the real merit of a plan, and degrades the contests of artillerists to the greed of gain and diplomatic manœuvring for profitable contracts, is, in a great measure, to be attributed to the notorious Armstrong monopoly, which so long excluded every competitor, whatever might be the value of his system, from even a chance of a trial. A bitter feeling was engendered in the minds of inventors, a strong opposition was organized, and, at last, became so powerful in behalf of an engineer of acknowledged talent —Mr. Whitworth—that Government found itself compelled to allow him the opportunity of fair competition. But even this concession is accorded as a favour, and the avenues to the honours and benefits of Shoeburyness experiments, at the public expense, are jealously guarded by official authority.

Public attention is now fixed on two candidates for ordnance favour and emoluments. Between them a great duel of target practice will be fought, whilst the systems of other artillerists, superior, perhaps, to the Armstrong or Whitworth, will, for a time, remain untried (officially), and unappreciated because untried. But let us be thankful for the success of the Whitworth diplomacy. The barrier of exclusive patronage is broken down, and much credit is due to him, if, as we are assured, he has resisted the blandishments of power and refused a coalition, which would have secured a new lease of monopoly to the Ellswick combination, of which he might have shared the profits. The chief instrument for upholding that lucrative speculation was the *Times*, which suggested that the talented engineer might find it to his advantage to combine with the titled artillerist. For some weeks past, however, the leading journal has refrained from its extravagant praises of the Armstrong guns, having seen its statements of their transcendant merits disproved by the results of experiments, in which they were surpassed by other guns in power, range, accuracy, and durability. We hope the official organ has ceased the unscrupulous partizanship, which was as discreditable to itself as to the departments by which it was inspired. We trust some of our contemporaries will take warning from the *Times*, and not allow their columns to be the vehicle of promoting personal objects, by recommending any system of artillery on any ground but its intrinsic merit. The discovery of the best service gun is of such vast national importance, that personal considerations ought not to be taken into account in submitting any system to trial, or in reporting the results.

Mr. Whitworth's exploit of penetrating armour-plates with explosive shell has excited much commotion, not unmixed with jealousy, in the scientific mind. The potency of the damaging effect is systematically underrated; the holes perforated in the iron may, it has been said, be easily plugged, and it is questioned whether the guns, however strengthened, will stand the strain of the heavy charges which must, it is alleged, be used to obtain the high velocities indispensable to perforate the plates. In this manner is a decidedly new and great discovery, on its being ushered into the world in a practical form, assailed by theoretical writers. Any merit for originality of invention is denied to the man, who has actually accomplished what others have been talking or dreaming about, without it would seem the capacity to carry out their own ideas. As well might the credit due to Watt, as the inventor of the steam-engine, which he practically was, be disputed, because the expansive force of steam was known, and some crude attempts at applying it to machinery were made before his time. With strange inconsistency, a scientific artillerist, criticizing the performance of the Whitworth shell, admits the fact that its success is due to "the thorough and accurate manner, in which, as a mechanical engineer, he has carried out the plan;" and then "confesses to a strong feeling of indignation to find all of the patient investigation, and careful statement of principles by others, virtually appropriated by a *working* engineer." This sneering allusion to a man, who is no less remarkable for his inborn genius, in the application of mechanics, than as a *thorough* practical, as well as a first rate working engineer, is, to say the least, in bad taste.

We are led to make these remarks, because a series of important trials of guns and projectiles will soon take place; and in our desire to obtain fair play for all, by not limiting the Government experiments to a select and favoured few, we bespeak the candid judgment of those who may take a part or feel an interest in the approaching trials; and we will set the example by an impartial survey of the principal systems which are entitled to be tested at the public expense.

What are the essential requisites of a serviceable gun? What are the means of attaining them? To the first of these questions we reply: accuracy of aim, with maximum range and velocity. The answer to the second question is the subject we propose to take into consideration.

We will not attempt to offer an opinion on the various modes of constructing guns. We should involve ourselves and our readers in a labyrinth from which we perceive no issue. So many and so different in one sense, and so similar in another, are the systems of rival gun-makers, that it would be a hard, and, after all, a useless task, to evoke order out of such discordant elements. The plans of so-called inventors of ordnance differ in details of construction, but in the main features they are alike; and so much is this the case, that there is not a single one of the number who does not accuse some other one of imitation, or assert that what is claimed as a new invention has long been known and practised. The fact is, that all conceivable plans of construction have one object in view, which is, to make the gun of sufficient strength to do its work. This result, we believe, may be attained in different ways, depending partly on construction, partly on material—two points which, in combination, are susceptible of many modifications, the description of which would be tedious and impossible within our limits.

We assume that a gun must possess the required strength, without which it is no gun at all; but what is meant by strength in a piece of ordnance—that is, resistance to bursting—often depends more upon some peculiarity in the bore, or the powder or air-chamber, or the projectile, or the mode of loading and firing, than on the solidity of the gun itself. Again, the strength must be proportioned to the charge to be fired—that is a normal condition. In every point of view, it will be found that this estimate of the question of strength is correct. In considering the merit of any system of steam-engine, it would be just as reasonable to enter into a discussion on the necessity of a boiler being strong enough to resist the pressure of steam, as it would be to insist upon the necessity of making a gun strong enough not to burst, which seems to absorb the attention of some of our contemporaries, as well as of competing gun-makers. As we have said, there are many modes of accomplishing that *sine qua non* condition, the most efficient of which we will not pretend to determine.

Accuracy of aim and maximum range, and velocity, irrespective of the powder charge, depend upon rifling and windage. We leave ordinary smooth bores to their original simplicity. Their character is defined and well known, and cannot be changed without placing them in another category. The essential requisites we have referred to can only be attained by rifling, which regulates and determines windage, whilst it materially influences the strain upon the gun. Hence the whole question is narrowed into the enquiry, "Which is the best mode of rifling?"

Although, nominally, the modes of rifling made known to the world are multitudinous, they may be classed under a limited number of systems, and by defining these we shall avoid confusion, and make our observations more intelligible than by pursuing the details of slight variations in form, size, depth, and number of grooves and pitch of the spiral curve, for all of which innumerable patents have been taken out, without any one of them being the right thing.

For simplicity and distinctness, we range all the known plans of rifling under five heads, corresponding to the methods of five well known gun-makers or inventors, with whose names the public are familiar. We mean Armstrong, Blakely,* Whitworth, Lancaster, and Lynall Thomas.

For convenience of reference we mention these names, but, in point of fact, other artillerists, as Scott, Hadden, Britten, and other British and foreign manufacturers or inventors, have adopted or proposed plans on principles analagous to some one or other of those systems, with the sole exception of the oval bore, which, from its nature, does not admit of colourable imitation like the others. We thus present five different types, and we think we can show that in their distinctive characteristics they comprise all the modes of rifling, which, up to this time, have been conceived. We leave rival inventors to assert their claims to originality; our object is to clear away some of the confused ideas on rifling, and explain the principles on which the methods in practice are based.

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* The Blakely guns, which have been manufactured and used in actual warfare to a great extent are, we believe, all smooth bores; but those exhibited at the South Kensington Palace were rifled on Commander Scott's plan, which, in the opinion of practical artillerists, is one of considerable merit.

The five systems we will designate—1. The narrow linear. 2. The broad deep groove. 3. The polygonal. 4. The oval bore. 5. The ribbed bore.

The first system is made available as rifling by the compression of soft metal forming the coating of the projectile. It is employed in the Armstrong breech-loader, and is said to be borrowed from Wahrendorff. The second is applied in the Armstrong shunt, and in the Blakely, Mersey, and other deep-groove rifled guns, which were exhibited at the International Exhibition. The third is the Whitworth plan, and has been termed the mechanical fit; but experience has already determined that, however desirable that peculiar feature may be, it cannot be maintained in practice. The fourth is Mr. Lancaster's invention, which strictly is not rifling, but a modification in the cylindrical bore, which produces spiral motion without rifling. The fifth is Mr. Lynall Thomas's system, which reverses the ordinary mode of rifling by forming spiral ribs in relief on the bore instead of cutting grooves into it.

The narrow linear method, in the proper sense of the term, is not a system of rifling *per se*. It is a medium for preventing windage and giving rotary motion to the projectile by covering it with a coating of soft metal, which, by compression, is forced into the narrow grooves. It is a *succedaneum*, not sound in principle, but empirical. The introduction of the soft metal is an obstacle, and, in one shape or another, produces difficulties which hitherto have not been, and probably will not be, overcome. The stripping off of the soft metal, its tendency to fill up the narrow grooves, and the varying strain on the gun in compressing the soft metal, are recognized as difficulties, some of which, to say nothing of their tendency to burst the gun, we can state from our own knowledge, not unfrequently drive the gunners to despair, and compel them to cease firing. To these defects is to be added the galvanic action of the lead or zinc on the iron of the projectiles, when these are kept in store any length of time. These palpable objections are of so serious a character, and, as we believe, irremediable, that there can be little doubt the "narrow linear" will ultimately be abandoned by the English, as it has been, after trial and mature deliberation, by several foreign Governments. The broad, or deep groove system, is exemplified in the Armstrong shunt, the Scott and Hadden, the Horsfall, and many other guns. We cannot perceive a difference of principle in any of these. The cut of the groove varies in form, and presents sections differing to the eye, but having, all of them, one of two characteristics—a loose fit to facilitate loading, and consequently causing an unavoidable amount of windage, or a close fit, causing a dangerous amount of friction and strain on the gun. To this latter action is to be attributed the bursting of heavy rifled guns, which is of such frequent occurrence. Some inventors, as a remedial measure, have tried soft metal ribs on the projectile; but the tendency to stripping and filling the grooves, as is in the case of the narrow linear, renders this method objectionable.

The mechanical fit, which promised so much, has not stood the test of actual practice. Every gun manufactured by Mr. Whitworth, strictly on that principle, has, it is said, burst after a not very long or severe ordeal; and although he demonstrated the precise accuracy resulting from a rigid adhesion to the "close fit," he virtually admits it cannot be carried out in practice, by the modifications he has introduced in his recently-constructed guns. Space, for the present, forbids our saying more with reference to this change than to point out that the mechanical fit, being abandoned, the Whitworth rifling ceases to be a system of itself, and comes under No. 2 of our classification.

The oval bore is not so much a system of rifling as a *quasi* smooth bore, slightly diverging from the circular, and thus effecting the object of rifling. The rotary motion is imparted to the projectile by its passage through an easy spiral channel, gradually rounded off from the circular circumference of the bore, which cannot properly be termed a groove, although it fulfils the functions of a groove. This method we regard as a move in the right direction; it is free from objections incident to the three first systems, but its action, in respect of windage and accuracy, is, at present, so undetermined that, we believe, Mr. Lancaster himself will admit that the "oval bore" principle, so far as can be judged from his attempts up to this time, requires mechanical modifications before it can be said to supply the essential requisite of a good service gun.

The "ribbed bore" has to be tested before its character can be determined. On a cursory view, Mr. Lynall Thomas's method might be thought similar in principle to Commander Scott's; but there is a distinctive difference. The latter is an angulated groove, cut into the bore; the former is a rib in relief, the groove being in the shot—a plan which entitles it to be treated as a distinct system.

A large gun on this principle is under construction at Woolwich, and will, we understand, be soon submitted to trial. In the meantime, we may offer some obvious remarks. Here we have ribs projecting from the surface of the bore, as guides, over which the grooves in the projectile run. If the bottom of the groove presses too closely on the top of the rib, the strain on the gun will be great; and being limited to the line of the rib, and not spread over the face of the bore, will the more tend to burst the gun. If the rib be so shallow, or the groove so deep, that the two come in contact only at their sides, the pressure of the shot will be against the cylinder of the bore, just as in the case of an ordinary smooth bore, with the same amount of windage. It would not be safe to allow less windage, as the pressure and friction on the sides of the ribs would alone be a cause of obstruction and of strain on the gun, which it would not be safe to augment. This lateral pressure on the ribs is the danger to be guarded against. It is to be feared that the continuous rubbing against the side of the grooves will gradually, especially if steel shot be used, wear away the rib, and tend to destroy the gun. This action (the cutting of the shot into the rib) is likely to be more damaging than the action of a shot rib on a rifled groove.

Accuracy of aim and velocity are, more or less, dependant on rifling. The former, it may be said, absolutely—the latter, contingently; the powder charge here being the main cause. The perfection of rifling would be a method which combined the mechanical fit, and consequently the absence of windage, with such a degree of resistance, as should offer no difficulties in loading, if a muzzle-loader, and no dangerous strain in firing. In these two essential conditions the three first systems are proved, by experiment, to be deficient Unless some improvement is made in the "oval bore," we may say it is in the same predicament. The "ribbed bore" remains to be tried.

In order to form a right conception of the action of a rifled projectile in a gun, from the moment it is set in motion by the explosive force of the charge, to its exit from the muzzle, we must consider the path it follows, and the friction it exercises on the rifled grooves, or ribs. These effects obviously are determined by the nature of the rifling, which, it may be said, overrides the whole question, and is, therefore, the real point to be considered. So vague and unsatisfactory, however, are the notions prevalent on rifling—so opposite to each other in principle are the systems and opinions of rival gun-makers and artillerists—that evidently the art of rifling is not yet understood, much less is it practised in accordance with scientific data, which admit of mathematical demonstration. Nothing is true which cannot be demonstrated.

It is not without utility to direct attention, as we have done, to some of the well-known modes of rifling, with the view of enabling engineers to form correct notions on the actual requirements of a good system. On this interesting subject we will take an early opportunity of offering some remarks.

We should not do justice to the ablest scientific writer on gunnery, Mr. Robert Mallet, C.E., F.R.S., if we did not acknowledge that we are indebted to his admirable essay on Artillery, exhibited at the International Exhibition, for some of the technical data above referred to; but we hold ourselves responsible for the conclusions we have drawn from them.

JOSEPH LOCKE.*

THE life histories of deceased engineers of note promise to afford an ever-renewing staple for the manufacture of biographies. There is a fascination in reading the true account of almost any man's life—a fascination stronger for most men and women than the dreamy blandishments of a novel. The biographical field is however, now-a-days, rather limited for the book-makers. Naval and military heroes have been fortunately rather scarce for the last thirty years. We have had no "thirty years'" war to furnish us with a fresh Gustavus Adolphus, or another Wallenstein. Interesting biographies could, no doubt, be written about many men belonging to the "learned professions," law, physic, and divinity. But it would be difficult to write a readable life of a physician or lawyer, without at the same time invading the secrets of private families. An engineer, however, may be said to deal with the secrets of nature and art. In modern, political, and social life, the educated masses are taking up the same position and power as the princes and nobles of former days. The modern engineer, with such a public for a patron, is playing the same part as the painter and architect of medieval Italy. Instead of erecting gorgeous cathedrals, or painting the frescoes of the Sixtine chapels, he builds Crystal Palaces for the multitude, and equalizes all conditions, by making the former luxuries of the few mere conveniences for the many. It is a trite remark that mechanical engineering is changing the whole aspect of life. The entire extent of its influence upon naval and military warfare, cannot as yet be determined. Rifled cannon and rifled small arms left their impress upon history at Magenta and Solferino. Colt's revolver keeps the Floridas against the Red man. The long range of the Armstrong gun helped to take us to Pekin; a city as fabulous to our ancestors as the realms of Prester John. In the words of Prince Albert, "Science and mechanical improvement have in these days changed the mere practice of cultivating the soil into an industrial pursuit." What mechanical invention can do in the arts of life is only beginning to be recognized in this century. Cardinal de Richelieu, when he imprisoned Solomon de Caus, the steam-engine projector, as a madman, forgot that insignificant and unknown mechanics had changed the world to a greater extent than all the statesmen and heroes since the days of Alexander. He forgot that gunpowder had struck down the feudalism to which he was giving the "*coup de grace.*" He forgot that the minute magnetic needle had discovered a world larger than the Roman empire. He forgot that Luther was but the natural sequence of Guttenberg; and he imprisoned the man who was offering him more power than was ever in the gift of a Cæsar.

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* "The Life of Joseph Locke, Civil Engineer, M.P., F.R.S., &c. By Joseph Devey." London: Bentley.

Any one of our readers could no doubt multiply these instances of the extraordinary influences of mechanical science on modern life. It will be evident that the lives of industrial heroes must afford much material for picturesque treatment. Accordingly, such histories are becoming quite a branch of popular literature. Such works will, no doubt, stimulate ingenuous youths, like the lives of our old Admirals. Their influence will be felt in many ways. Instead of running off to sea, our rising generation will want to be engineers. Should a fond parent ever discover his boy scrawling on a slate the faintest resemblance to an engine, or should he be seen making a dirt pie with the least resemblance to a locomotive, the unfortunate boy in question will be immediately dubbed as a "mechanical genius." For the consideration of a hundred or so a year, after having been dosed with the usual quantum of Latin, he will be put with some noted engine maker, who will give him his first and last look when he takes the premium. After having played at working for three years or so, he will come to swell the ranks of a business as overcrowded as most others.

As soon, therefore, as an eminent engineer's body becomes, in the course of nature, food for worms, his life will be legitimate forage for writers.

The love of these latter gentlemen for their chosen subject, is said to exceed in intensity "even the love of woman." Small men will be made heroes of; their mistakes will be hidden or diminished, and their achievements looked at through a strong magnifying glass, tinted with "couleur de rose." Should we wish to get at the real truth, we shall have to read a series of these works, as reciprocative corrections of each other. This latter process, however, will be good for both authors and publishers.

We wish that Joseph Locke, who was an eminently honest, able, and energetic man, had been more fortunate in his biographer. We also wish that Mr. Devey had at least more science and taste, and a little less classical learning. In the words of Macaulay, "here and there a manly sentiment makes its appearance in company with Prometheus and Orpheus, Elysium and Acheron, the plaintive Philomel, the poppies of Morpheus, and all the other frippery, which, like a robe tossed by a proud beauty to her waiting woman, had long been contemptuously abandoned by genius to mediocrity." How Locke himself would have smiled if he had been told that he had constructed works "vaster far, and far more important" than the walls of Thebes, and that his undertaking of "carrying a railway across Shap Fell was perhaps as serious an undertaking as digging the trenches of Rome." Mr. Locke is successively compared to Alfred the Great, Cromwell, and to the Roman Curtius.

When a boy, Mr. Locke would not rock a baby's cradle; so he is compared to Alfred refusing to watch the Saxon house-wife's cakes. He intended, while in a youthfully despondent state, to emigrate to America. Forthwith Mr. Devey compares him to Cromwell. Having wept while thus desponding, Locke's biographer says: "There are some tears more potent even than those of Helen; and even from them sprang a plant, whose leaves cured the bite of serpents."

Trevethick, turning away from his locomotive to take up other schemes, is compared to "Attila turning away from Rome." No less personages than Venus and Æneas, Eolus, Neptune, Erinnys, and Polyphemus, are brought into the field. Mr. Devey has also explored the classical regions of Erebus and Arcadia, in search of apposite comparisons. We suppose that, in case Mr. Devey should ever write the biography, for instance, of Mr. Fowler, the steam-plough engineer, Mr. Fowler will be represented as celebrating the marriage of Ceres and Vulcan. It is a pity that this classical frippery should be jumbled up with much that is interesting and sensible. There are, however, other errors not merely errors of taste. In the course of our by no means very careful perusal of the volume, we have met with several curious passages, which make it evident that Mr. Devey is in a state of rather blissful ignorance as to scientific matters.

What is meant (p. 64) by a "*left-tenter*" to equalize steam pressure. (Page 72)—It is stated that Trevethick "took out a patent for *heating* the *surface* of the boiler by means of small tubes." We are informed (p. 118) that "steam, operating upon an imprisoned atmosphere, generated much carbonic acid gas!" What is meant by "*steam machines* (*sic*) *accompanied by a dagging apparatus?*" (p. 59).

Mr. Devey very sensibly begins the book by an account of his hero's ancestry. This is a point too often neglected by biographers. In the East, the doctrine of hereditary transmission has been practically recognized for ages. The Turks say that the father is known by the son, and the Chinese ennoble the ancestry, and not the descendants, of a distinguished man. We believe that in Franklin's autobiography that extraordinary man alludes to the fact of he himself being the exact counterpart, in mind and face, of his English grandfather. We consider that Locke's father, if Mr. Devey's account of him be true, would, with the same opportunities, have done as much as his own fortunate son. But, as Mr. Devey himself would say, "Where would Achilles be without a Homer?"

Joseph Locke, the son of William Locke, was born in the year 1805, on Attercliffe Common, near Sheffield. He was the youngest of four sons, a merry, mischievons, active lad, with plenty of "*amour propre*" in his mental composition. He was taken from the Barnsley Grammar-school when only 13, so that he owed his success in life more to "mother wit than school wit." According to the homely German proverb, an ounce of the former is worth a pound of the latter. On leaving school he was first placed with a Mr. Stobart, a coal viewer, and next with a young land surveyor. The self-love of the boy rebelled on its being required of him, that he should take Mr. Stobart's letter-bag to the post-office on his shoulders, and that the land surveyor should order him to rock the baby's cradle. He, therefore, wisely threw up both these situations. His father, William Locke, being now the manager of a colliery, employed Joseph "to 'lead' coals in a cart to houses in Barnsley." This the boy of fifteen felt as a degradation, and he meditated, like most active spirits at one time or another, emigration to America. It is easily seen by these trials that the motive power of Joseph Locke's character was a strongly developed *amour propre*. Towards the end of the year 1823, George Stephenson, who was an old acquaintance of the father, from having worked with him at Newburn, came to see his old friend, and took Joseph on as an apprentice in his Newcastle workshops. This was the tide that led Locke on to fortune. Henceforward, his biography is, to a great extent, the history of the iron roads built during the last thirty years.

While in the workshops at Newcastle, Locke "eschewed delights, and lived laborious days." He made up for the deficiences of his scanty education by studying of an evening, after the day's work. He was thus prepared, theoretically and practically, for the great railway campaigns that ensued after the famous locomotive trials in 1829, on the Manchester and Liverpool Railways. Locke first publicly distinguished himself by writing, in conjunction with Robert Stephenson, a pamphlet, entitled "Observations on the Comparative Merits of Locomotives and Fixed Engines, as Applied to Railways, being a Reply to the Report of Mr. James Walker;" Mr. Walker having advocated fixed, instead of locomotive engines, for working the Manchester and Liverpool line. This pamphlet determined the question in favour of the locomotive, but "George Stephenson had urged that the title-page should bear his name, and his name only." Locke refusing to concede this, a coldness was engendered between himself and his employer, that ultimately, fomented by other causes, led to a complete breach. Locke also discovered serious errors in the laying out of the tunnel which connected Edgehill with the station in Lime-street, on the Manchester and Liverpool line. These mistakes had been overlooked by Stephenson, and the results were increased confidence on the part of the directors, in Locke. "Hence, after the passing of the Grand Junction Bill, in 1833, when the appointments on the line came to be made, Locke was inclined to expect very much, and Stephenson was inclined to give very little."

The upshot of all this was that, in 1834, the now rivals were appointed joint engineers, and this not answering, Locke was appointed engineer-in-chief in August, 1835, on the retirement of George Stephenson from the joint management of the then Grand Junction Railway.

As far as we can understand Mr. Devey, he seems to claim for Mr. Locke the introduction of the double-headed rail, and the wooden key during his engagement on this line.

In 1833, Locke married the daughter of Mr. M'Creery, a printer, and the author of a poem called "The Press." The union seems to have been very congenial and affectionate, and invigorated by domestic happiness his mind was able to entirely concentrate itself on his great undertakings. On the resignation of Mr. Giles, Locke was appointed engineer of the line between London and Southampton. When this railway was about half completed, he was appointed engineer of the line between Sheffield and Manchester. On this work he achieved, at Woodhead, the great tunnel, perforated through what is "called the back-bone of England, being a portion of the central mountain line which divides the country."

His next line was the Preston and Lancaster, followed by the Lancaster and Carlisle. This latter railway had to encounter a rival project in Parliament for taking the Morecamb Bay route. Mr. Locke's first railway in Scotland was a line between Greenock, Paisley, and Glasgow. He laid out several other Scotch lines, amongst which was the Caledonian—another line that had a fierce battle in Parliament with a rival project. The only result was, that about half a million of money got squandered in Parliamentary expenses. Every traveller on a line thus highly favoured by Parliamentary supervision, has thereby to pay considerably more than would otherwise be exacted.

In France, Mr. Locke built the Paris and Rouen, the Rouen and Havre, and ultimately the Caen and Cherbourg lines. He also built the first Spanish railway, the line from Barcelona to Maltaro. This undertaking undoubtedly gave Spain the first impetus in the direction of modern progress. The Dutch-Rhenish Railway Company refused to take his advice against the adoption of the 6 ft. 6 in. gauge, and has thus isolated itself from the German lines, to the great impairing of the shareholders' dividends. He was the member in Parliament for Honiton from 1847 till his death, in 1860. With his usual concentration and common sense, he confined his Parliamentary duties to those subjects with which he was acquainted by practical experience. He greatly distinguished himself against the Sabbatarian bigotry that left the amiable Duchess of Sutherland weeping on the railway platform, while a seat in the mail train would have enabled the Duchess to close the eyes of her dying father. In the session of 1851 Mr. Locke introduced into the Commons the Railway Audit Bill which Lord Stanley had carried through the House of Lords during the preceding session. The bill, however, fell to the ground. He brought his experience acquired in the successful prosecution of great joint-stock undertakings to bear upon such subjects as the Thames Embankment, the Westminster Bridge, Dockyard Expenditure, the Ordnance Survey, the Netley Hospital job, &c. His weight—as a speaker—on these departments of public business was so far felt, that he was generally talked of as the successor to Sir Benjamin Hall as Commissioner of Public Works when the latter was elevated to the peerage. It was, however, probably thought that such a man as Locke was too combative for the lotus-eaters of official life.

In his latter days he took to field sports, and pursued his birds with the same energy he used to display towards scamping contractors. While thus enjoying himself on his moor in Scotland, he died after an illness of scarcely twelve hours, in September, 1860. He is buried in Kensal Green. Joseph Locke's character was of an essentially English stamp He was an incarnation of common sense, integrity, combative energy, and mediocrity. To use his own words, when President of the Institution of Civil Engineers—"The profitable effect of capital, directed to a given object in the hope of profit, is the main element of the subject in which the *modern* engineer has to exert his skill and judgment." This truth formed the keystone of his practice, and consequent success. The following is a passage worth quoting out of this book:—"The world is more indebted than is commonly supposed to people of average understanding. They originate no new ideas; they leave this task to genius. But they carry a good many of them out, when genius, whose own ideas they have already accepted, would prevent the acceptance of any others. The initiative in progress is taken by genius, but not less by it is taken the initiative in opposition to progress. It is no less true than fortunate, that a majority of those who could initiate nothing, invariably sides with the former. Were men of genius to unite their mental forces, we should probably soon reach the goal towards which progress points. But as their mental forces appear to be about equal and opposite, it requires a considerable preponderance of the inferior mental forces to act in the right direction for us to move forward at all." Locke first reduced the management of contractors to a system. "Crooked contractors found this out, to their utter discomfiture, and even straightforward contractors to their occasional loss." Accordingly, he was the best abused man in England amongst this class generally.

The chief feature of the more recent railway practice is the adoption of the cheaper system of steep inclines and sharp curves. This is more especially the case on the continent. In 1843 Mr. Locke was examined before the French Chambers with respect to the supposed danger of working an inclined plane of 1 in 110. The French engineers fixed the lowest point of safety at 1 in 200. Mr. Locke was allowed to adopt a descent of 1 in 125. Gradients of 1 in 50, or even 1 in 35, are not uncommon on the lines in Germany. Mr. Locke's common sense showed itself very conspicuously in the famous battle of the gauges in 1845. The pamphlet he published on the subject came too late to effect a cure, the evil being already accomplished. We may regret that a broader gauge than 4 ft. 8½ in. was not adopted from the first, but, under the circumstances, Mr. Locke's course in reference to this question was the true one to be adopted. There could not be a greater contrast between the brilliant transplanted Frenchman, Brunel, and Locke, the Northcountryman. A direct contrast as to personal qualities, engineering practice, and the results of that practice, Brunel would have done very well as the servant of a Louis XIV., but as a servant of shareholders he was a costly failure. Despots with their hands in the purse of a nation, want works of art at any cost: shareholders only want half-yearly dividends. An engineering *Punch* might make a very good cartoon, entitled, "Engineering à la Mode," by showing a section of the Thames with *M. I.* Brunel's tunnel, and *I. K.* Brunel's Great Eastern floating in the river above.

The monuments of both Locke and Brunel may be found in certain share-lists. The one monument is, however, a triumphant arch; the other is a gravestone to defunct hopes and burnt scrip.

This is, upon the whole, a very readable book, which is the main thing in a book, just as common sense is the main thing in engineering practice. A strongly marked portrait is given of Locke the engineer, though the picture is marked by many blotches, some of which we have pointed out. The summary of the railway events of the last thirty years is also compiled in an interesting manner. Mr. Devey has evidently written his book *con amore*, but this love of his subject has occasionally led him into exaggeration. Talleyrand's recommendation of "*surtout pas trop de zèle*" would not be unappropriate to a man undertaking a work of this kind. In case Mr. Devey should ever write another engineering biography, we hope that he will draw less of his inspirations from "Lemprière's Classical Dictionary," and more of his facts and terms from a good technical vocabulary.

II.

IRON CASED SHIP-BUILDING.—IRON CASED SHIPS.

The *Standard* of Tuesday last contains an article on the progress being made in building "The Enterprise," and "Favourite," under the superintendence of Mr. Reed, at Deptford. After some very complimentary remarks, the writer says:—

Before mentioning these two vessels more particularly, it will be well to observe that a peculiar concurrence of circumstances enabled, or rather forced, the Board of Admiralty to act in the way described in reference to Mr. Reed's proposals. In the first place, Lord Clarence Paget and his colleagues found themselves in a condition of utter helplessness, being fairly drowned by the tide of events which they were too weak to stem, and they were, therefore, ready to clutch at anything which held out the promise of a rescue. Few thanks for the promptness with which they acted. In the next place, the suggestions to which they gave their approval emanated from a person who could not well be resisted even under far more favourable circumstances. Mr. Reed was trained originally in the Admiralty service; he had gone through all the steps which are usually held indispensable to an Admiralty constructor; years before he had attained a high position as an authority on questions of naval construction; he had even been offered a seat in Parliament, expressly in order that the Government of the day might benefit by his advice and knowledge; he had secured a high position as a public writer on naval questions, articles in the *Cornhill Magazine* and other publications of influence, being known to proceed from him; he had been fixed upon by all the leading shipbuilders of the kingdom, public and private, as the most suitable person to found and lead the Institution of Naval Architects; and last, though not least, he was known to be—by virtue of his official connection with that institution, if not otherwise—on terms of confidence with the most active, enterprising, and influential naval reformer alive, Sir John Pakington. All these things rendered it impossible for an Admiralty which had no better secretary than Lord Clarence Paget to resist the opinions and wishes of Mr. Reed, and at the same time they enabled the board to accept his views with little or no regard to the traditions and prejudices of their own antiquated professional advisers. It may be true that Mr. Reed's name has not been thrust forward at trials of iron-cased ships, at Shoeburyness experiments and elsewhere, like the names of Scott Russell, Fairbairn, and others, who seem to think that nothing can prosper without their aid; but this was an advantage both to the board and to Mr. Reed, since it left his suggestions free to stand only upon their merits, while his long acquaintance with the ins and outs of things at Whitehall and in the Royal dockyards gave his words a degree of weight for which no show or pretension on the part of others could compensate. We will now turn to Mr. Reed's first vessel, the "Enterprise."

On visiting this ship one's first impressions are somewhat confused, owing to the utter unlikeness of the ship to anything before seen in this country. A high, square, solid-looking tower rising up from a low, shallow, sneaking-looking hull, after a fashion that one might stumble upon in America without astonishment, but that seems strangely different from everything to which one has been accustomed here. On examining the actual state of things, however, we soon find that the singular appearance of the ship is due only to the fact that we see her in an incomplete state, the iron upper works having yet to be erected. When these have been built up—and the workmen are now about to commence them—the tower will become embodied, so to speak, in the general form of the hull, and the "Enterprise" will very much resemble in external appearance an ordinary steam sloop. The form of her bow and stern will, however, be very unusual. The timber stem has been carried in a curved form below the water, in order to act as a ram, while the light iron upper works will recede from the water line, in order that they may not suffer when the blow of the stem is delivered. The stern, again, is entirely novel, having been designed and formed, we are glad to say, so as to avoid the serious and disgraceful blunder which has been committed in the "Royal Oak" and other ships of her class, and by which the rudder-head is exposed to the direct blow of the shot. The "Enterprise" is the first British ship of war which has had her stern or counter immersed sufficiently to protect the rudder-head thoroughly, and therefore the first that will be able to go into action with confidence in the preservation of her steering powers. For Mr. Reed has protected, not the rudder-head only, but the steering-tiller also, notwithstanding the increased difficulty of accomplishing this in a small ship. The plan will doubtless be carried out in every ship of war constructed hereafter, and Mr. Reed deserves credit for having set so excellent an example. In consequence of this depression of the counter the form of the ship abaft is, of course, made very unusual. In fact, the stern will "tumble home" in very much the same way as the bow, and will, in fact, look very much like it. The "Enterprise" has, at the same time, been made so strong and solid aft that she could probably deliver a blow with one end as well as with the other, and without damaging her steering gear, if the rudder itself is not too large to admit of that. Another cause of difference between the "Enterprise" and of other ships in the concentration of her armament. In the whole length of her side—180 ft.—she will show but two ports only, but out of them 110 pounder Armstrong guns will pour forth their tremendous missiles with a far more terrible effect than any number of the small guns that sloops usually carry can produce.

The armour of the "Enterprise" will consist of three separate masses, so to speak. First, there will be the belt going entirely ronnd the ship in the region of the water line, this belt being 4½ in. thick at the upper edge, and tapering off to 3 in. below. Next there will be the armour on the sides of the battery, rising from the belt up to the battery roof or deck. This will be 4½ in. thick from top to bottom. Lastly, there will be the armour upon the athwartship bulkheads, which protect the guns and gunners from a raking fire. This will be 4 in. thick above the upper deck, and 3 in. between decks. The upper deck will be of iron, covered with deck plank, except in the wake of the ports in the bulkheads just mentioned. These ports, taken in combination with other arrangements connected with them, constitute one of the most important features of this admirable ship, and, in fact, of Mr. Reed's system. The advantage gained is, that of being able to get an almost fore-and-aft fire at point-blank range, and a perfectly fore-and-aft fire with slight elevation from the centre of your ship. By keeping the upper iron deck of the "Enterprise" below the portsill of the battery, the designer is able to employ the whole of his four heavy guns in fore-and-aft firing —a result never before achieved even with the heavy pivot guns which have so long encumbered the bows and sterns of our men of war, causing them to pitch fearfully in a seaway, and straining them all to pieces continually. We doubt if any sloop or corvette of war will henceforth be built without having this provision made in her. The offensive and defensive powers of the "Enterprise" will undoubtedly be rendered most terrible by the facility with which she can bring her large guns to bear in all directions.

We have already spoken of the form of the ship above the water, which will be well adapted, as we have seen, for the work of actual service, and will not, we believe, be unsightly. Of the form of the bottom we speak with still greater praise. We believe the "Enterprise" to be the handsomest ship below the water that exists in any of the dockyards. The beauty of the lines arrests the eye of every visitor, and is a constant theme of admiration among naval men. We are given to understand that Admiral George Elliott, the newly appointed superintendent of Portsmouth Dockyard, and well known as one of the smartest and most enterprising officers in the service, expressed himself much pleased with the form of the "Enterprise" on the occasion of his visit to her a few days ago; and, as the captain of the "Phaeton" frigate in her palmy days, he must be extremely well qualified to judge of such a matter. In fact, there can scarcely be a doubt about the excellence of the "Enterprise" as a sea-going craft, for not only is her model beautiful, but her extremities will be so light and buoyant that she will doubtless float and turn about like a duck upon the water. The whole of her principal inboard weights, and nearly the whole of her armour, are concentrated in the middle of the ship, where there is the body of the ship to support them; while the ends will contain little or nothing but the officers and crew and their traps; and it is well known that nothing is so favourable to both sailing and steering as this collection of all the great weights at the centre of the ship. There is every reason to believe, therefore, that our first English iron-cased sloop will be not only capable of going to sea, but one of the handiest and easiest crafts under canvass in the service, with the light but efficient rig which has been devised for her.

The strength of the "Enterprise" has been a subject of some discussion in naval circles, but we believe a visit to the ship herself must set every one's doubts on that point at rest. In the wake of all the armour, including the encircling belt, the timber frame, though small in scantling, has been made solid everywhere by means of filling timbers, so that there is throughout a backing of at least 18 inches of solid timber to receive the armour, and in the vicinity of the water line the thickness of the solid wooden side must be at least two feet. As regards her strength in a seaway, that must be perfect in so far as the timber hull is concerned, because in addition to the features just mentioned, the transverse bulkheads, formed of 12-in. teak timber in two layers, bind the extremities of the battery together so firmly that it will be impossible, we think, for the sides to yield or strain even when the ship is rolling under the worst of circumstances. With regard to the iron upper works, there can be no reason why they should not be as strong as the upper works of any ordinary iron ship, while of the sufficiency of the connection between the timber hull and the iron the ship-building officers engaged upon the ship seem to enteriain no doubt at all. In fact, we believe the Board of Admiralty themselves, who are not very competent judges of mechanical matters, are probably the only persons who think it necessary to suspend their judgment upon this feature of the ship until after she has been tried at sea.

A very few words will suffice for the iron-cased corvette "Favourite," which is being built upon the next slip to the "Enterprise." The principal features of the two ships are alike, but the armour of the "Favourite" is to be carried up to the gun platform, which is to be continued right fore and aft in the ship, and is to form, in fact, the upper or spar deck. This will require a larger proportionate amount of armour than the "Enterprise" plan, but it will do away with the necessity for erecting upper works of iron, and it will render the "Favourite" a completely protected ship. Although a less light and handy craft than the "Enterprise," the "Favourite" will be a fine sea-going corvette, carrying eight of the largest guns, and yet of but little more than 2,000 tons. The misfortune is that she is having a good deal of unseasoned timber put into the stern portion of her frame, owing to the absence of a proper supply of seasoned material, and this will probably lead to some delay in her completion.

SCREW SHIPS OF WAR.

In 1844 the "Arrogant," by the advice of the late Lord Herbert, then secretary of the Admiralty, was laid down for a screw-frigate, with auxiliary power, as an answer to the menacing attitude of France, the increasing proportions of her steam navy, and the celebrated pamphlet of the Prince de Joinville. To the auxiliary-powered "Arrogant" succeeded full-powered frigates, "blockships" of evil renown, and magnificent liners, mounting from 90 to 130 guns, all propelled by the screw, and in some of the finest of the frigates and liners driven by engines of a thousand nominal horse-power, capable of working up to 4,000-horse at full pressure of steam. Next came the "iron" age, represented by the "Warrior," of 6,039 tons, and carrying but 40 guns behind her iron walls, her screw driven by engines of 1,250-horse power. We are now entering upon a new phase in the introduction of Capt. Coles's turret and Mr. J. E. Reed's central square tower systems, the former being applied to the "Royal Sovereign" and "Prince Albert," and the latter to the "Favourite" and "Enterprise." As we progressed through these different stages so has the cost of our ships increased. We still retain the screw as a means of propulsion, and we cover the lofty masts of each ship as we send her to sea with a mass of wood and cordage sufficient to foul and disable the screws of a whole fleet if knocked overboard in action or in a breeze. We have been engaged all these years in testing the powers of the screw, and have also learnt its great attendant, fault. A turn or two of a rope's end, and the screw becomes fixed, and the 14-knot ship, with her magnificent engines, becomes helpless on the water, as far as her machinery is concerned.

Since the commencement of the formation of our screw fleets by the launch of the "Arrogant," the thought ever dominant in the mind of the naval officer has been, How could a screw ship be rigged so as to lessen the danger of fouling the screw by falling spars and rigging or floating wreck? The question has, in the meantime, been often enough discussed by officers of the royal and mercantile marine, and by ship-builders and scientific men on shore. Some have contended for the retention of the ordinary three masts for a full-rigged ship, while others have advocated the addition of a fourth or even fifth mast for the longest ships. Some few have even gone so far as to argue that our iron-clads can never, under any circumstances, if clothed with armour all round, like the "Minotaur" will be, be made safe sea-going ships; and, as they will possess engine-power which they can use economically by a low pressure of steam, they ought to depend upon steam alone for their motive power. So far, all the disputants have agreed that the present form and description of masts, yards, and sails, must be made use of with three or four masts, or the ship must depend upon her steam power alone. There are, however, two existing modifications of rig and disposition of spars introduced by the Admiralty in the "Defence" and "Resistance." No one, however, could wish to see such specimens multiplied. With the usefulness of their Cunningham self-reefing topsail, marred by attaching it to a fixed Howe's (American) topsailyard, and their unsightly head and after-sail arrangements, they look everything that is ugly aloft in a seaman's eye, while they are perfectly inefficient under sail, as compared with the "Warrior" or "Black Prince."

The advent of the turret-ships has, however, led to plans being laid before the Admiralty for masting and rigging our sea-going iron-clad ships on an entirely novel principle, superseding altogether hempen rigging, cordage, and wooden masts, by iron tubing and chain, exactly as iron ships have superseded wooden ones for all future purposes of war. It is proposed in these plans to give the ship tripod tubular iron masts, the central, or foremost, of the three tubes being of sufficient length to act as lowermast and topmast, and without tops or cross-trees. A long wooden topgallantmast fidded abaft the topmast head would carry topgallantsails and royal. Topgallant and royal yards would be of wood, but topsail and lower yards would be built of tubular iron, like the masts; all three masts and spars to be of equal dimensions. The advantages claimed for the tripod over the ordinary system of masting are—1, Having no lower stays, they present no obstacle to the fire of the guns in the cylindrical shield or turret, in whatever direction they may be trained. 2, The yards can be braced up nearly fore and aft, or in a line with the keel, enabling the ship, when under steam, to set sail and steer her course when with the present rig she would be obliged to furl her sails. This last position was forcibly illustrated in the escape of the English steamer "Thistle" from the United States' corvette "Tuscarora," off Madeira, on the 29th of November. 3, In action, the wooden topgallantmasts being sent down, the ship is in her fighting trim. Her topsail halliards and sheets leading down between decks through her tubular masts, sail is set and taken in as required by the crew without exposing a man on deck. If all or any portion of the masts and yards are shot away, being of iron, and having no rigging attached to them, they would sink immediately on falling overboard, without a possibility of fouling the screw. 4, On the mast platforms, which are laid on the braces connecting the legs of the tripod, they furnish a set of fortresses for riflemen to repel boarders, &c. 5, From their great strength they are well adapted for withstanding the shock of a collision when using the ship at full speed as a ram. 6, They will enable a ship to carry a greater spread of canvass, with less weight aloft, than can be done with ordinary masts and rigging. They afford great means of ventilation, are durable as the hull of the ship itself, would not be subject to the effect of climate, and the enormous wear and tear of ordinary masts and rigging would be thus avoided. 7, The masts and yards being all equal in size, and fixed at equal distances, the yards cannot lock when braced sharp up, and, the centre of effort of the sails being thrown well forward of the line of resistance of the hull, the ship will wear easily and rapidly, a quality in which our iron ships afloat, and more especially the "Warrior" and the "Black Prince," are said to be very deficient. The adoption of the tubular tripod masts would also, without doubt, save the enormous annual expense which is now incurred in the deterioration of the rigging of our ships of war kept ready for service in the first-class steam reserves.

The following are the general dimensions of the shield-ship proposed by Captain Coles as a sea-going vessel, compared with the "Defence":—

	Shield Ship,		"Defence."
Length	285 feet	...	280 feet.
Beam	50 ,,	...	54 ,,
Tonnage	3,700	...	3,720
Draught of water	23 feet	...	26 feet.
Nominal horse-power	800	...	500
Height of guns out of water	13 feet	...	9 feet 6 in.

As regards the spread of sail and weight aloft, the following comparisons are drawn:—

	Area of canvass in square feet.	Weight in tons.
Ship with tripod masts	32,456	190
Defence	22,529	162
A first-rate, or 120-gun ship	29,705	226

This gives the tripod-masted ship a spread of 9,927 square feet more canvass than the "Defence," at an increase of 28 tons more weight. In comparison with the first-rate, by which the "Warrior" and "Black Prince" may be judged, the tripod ship spreads 2,751 square feet more canvass, with a less weight of 36 tons, and as the tripod shield ship would draw less water, and have less beam, it is claimed that she would be much the faster ship under sail.

The word "turret," made use of in referring to Captain Coles's ships, has been used advisedly, the sloping shields which were to crown the towers having been abandoned by the Admiralty, together with breech-loading ordnance for their armament. The "Royal Sovereign," at Portsmouth, and the "Prince Albert," building by Messrs. Samuda, will, therefore, now be fitted with turrets of a similar fashion to the "Monitor," and will carry as heavy muzzle-loading ordnance as can be made for them. The "Royal Sovereign" is not to be fitted with masts, and consequently can only be looked upon as forming a part of our home defences.—*Times.*

Grandeau has discovered rubidium in the ashes of the beet, in tobacco, coffee, tea, and raw tartar. The author believes that this metal is one of the more widely distributed elements, and that its presence is not necessarily associated with that of lithium, as might be supposed from the analyses of minerals and mineral waters.

THE SCOTCH IRON TRADE.

WE extract the following from the annual report of Mr. Thomas Thorburn, of Glasgow:—

"Scotland shows a marvellous progress in the development of the iron trade. The steam-engine, the hot-blast, and the railway system, have doubtless contributed to this prominent feature of our national prosperity. And it is to be recorded for the information of the world that, in less than half a century, the production of pig-iron has increased more than one hundred-fold. Seven years ago, the stock of pig-iron in Scotland did not exceed 100,000 tons. Now our wealth in this the most useful of metals has accumulated to at least 720,000 tons, which, calculated at the average price for the year, in sterling money, is £1,900,000, thus approximating to the amount of gold bullion held by the Scotch banks. And it may reasonably be expected that the combined, steady, and well-directed efforts of producers and capitalists will, in the course of two years, achieve the grand result of a stock of one million of tons. The quantity of pig-iron produced in the year just closing is computed at 1,080,000 tons, which, valued at the year's average price, represents £2,850,000 sterling. The exports, foreign and coastwise, combined with the local consumption, amounted to 970,000 tons. The stocks, therefore, show an increase of 110,000 tons when compared with the same period of last year. It may arrest attention that, whilst the stocks have been steadily increasing, the price has risen from 49s. to 57s. 6d. per ton. This has, no doubt, been owing to speculative operations in the article, based upon a sanguine belief in an early settlement of the American war; but the advance arising from this expectation has been very shortly maintained. The lowest price was 48s. in January, and the average for the year is 52s. 10d. per ton. The malleable iron-works, the foundries, and the ship-building yards on the Clyde, are generally well employed; and should the belief in the superior advantages and impregnable character of the iron-clad ship gain ground, it may reasonably be hoped that those great branches of national industry will continue to flourish. Since the Irish famine, which the great wealth and greater charity of this country encountered and overcame, there has been nothing approaching the enormous suffering and destitution arising from the cotton famine in Lancashire. But it is a matter of unspeakable satisfaction that the resources of this great country, including very particularly those derived from the successful development of the iron manufacture, are adequately alleviating this unprecedented distress. The hope may therefore be confidently entertained that the iron trade, as hitherto, will continue to increase; and that, whilst adding to the wealth of Scotland, it will contribute to the civilization and prosperity of the world."

HORNSBY AND SONS'S ROOT PULPERS.

PROVISIONALLY PROTECTED, Dec. 4, 1862.

IN our late account of the Smithfield Club Show, we promised our readers a description of Messrs. Hornsby and Sons's patent root pulpers and turnip cutters. These implements were among the novelties of the show. The accompanying engravings show the root pulper; the turnip cutter we intend to give next week.

These pulpers are fitted with single diamond-pointed knives of steel, each one fixed in separately with a wood wedge, so that they can be easily adjusted or replaced by any farm-labourer.

At the base of each knife there is a clearance hole through which the pulped roots pass. This reduces the power necessary to work the machine.

The cutters or knives are so arranged that "no two of them pass over the same track;" consequently the roots are equally cut over the whole surface, causing the cutting action to progress regularly.

To prevent the escape of the last piece, and to clear the cutters, the machines are fitted with a patent oscillating bar, having teeth through which the cutters pass, and which receives motion from an eccentric on the spindle. This simple arrangement does away with gearing or worms, and also prevents the material being squeezed, whereby the nutriment is lost.

FIG. 1.

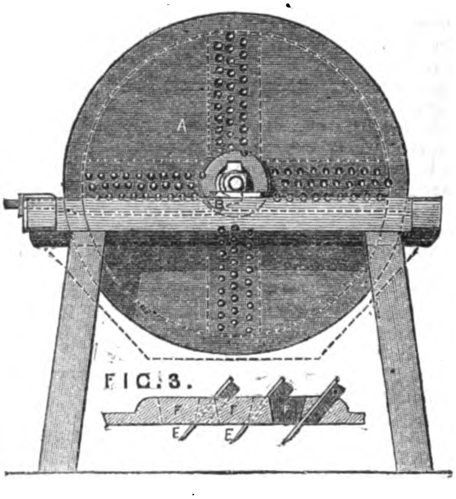


FIG. 3.

FIG. 2.

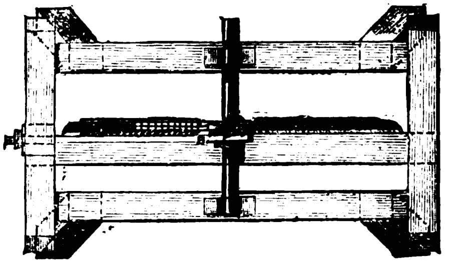


Fig. 1. Side elevation of root pulper.
Fig. 2. Plan view of the same.
Fig. 3. Section through part of the disc.

A	Fig. 1.	The side of disc, showing the knives and clearance holes.
B		The oscillating bar working from an eccentric on the spindle.
C	Fig. 2.	Shows the knives passing through the teeth of the oscillating bar B.
D	Fig. 3.	Wood wedge for fastening the knife.
E		The knife.
F		The clearance hole through which the cut roots pass.

MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

CHIEF ENGINEER'S MONTHLY REPORT.

AT the last ordinary monthly meeting of the Executive Committee of this Association, held at the offices, 41, Corporation-street, Manchester, on Tuesday, January 6th, 1863. (William Fairbairn, Esq., C.E., F.R.S., in the chair), Mr. L. E. Fletcher. chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month, ending December 31st, 1862, there have been examined 430 engines—3 specially; 621 boilers—12 specially, 9 internally, 54 thoroughly, and 556 externally, in which the following defects have been found:—Fracture, 4; corrosion, 33 (1 dangerous); safety valves out of order, 13 (2 dangerous); water gauges, ditto, 24; pressure gauges, ditto, 9; feed apparatus, ditto, 1; blow-off cocks, ditto, 32 (1 dangerous); furnaces out of shape, 7 (2 dangerous); blistered plates, 1. Total, 124 (6 dangerous). Boilers without glass water gauges, 6; without pressure gauges, 16; without blow-off cocks, 27; without back pressure valves, 44.

EXPLOSIONS.

"While I am happy to be able to report that no explosion has happened during the past month to any of the boilers under the inspection of this association, the occurrence of five explosions in other quarters during that period has come to my knowledge. Each of these has been attended with fatal consequences, 26 persons in all having been killed, and upwards of 32 injured. Two of the exploded boilers were personally examined.

"The first of these explosions, and from which 10 persons were killed and 26 injured, occurred at an iron works. The boiler was a horizontal one, of plain Cornish type, with a single internal flue, and a longitudinal steam chamber fixed above the shell. It was heated, as his common in such works, by the flames passing off from the iron furnaces; the flames of one of these passed through the internal flue in one direction, and those from two others passed outside the shell in the other direction. The furnaces were placed immediately at the ends of the boiler, one at one end and two at the other.

"The dimensions of the boiler were as follow:—Length, 25 ft.; diameter of the shell, 5 ft. 3 in.; of the internal flue tube, 2 ft. 3 in.; thickness of the plates, three-eighths throughout, with the exception of the flat ends, which were half inch, and strengthened with gussets in the ordinary way.

"The wreck was so complete that scarcely a trace of the fittings remained; but they are reported to have consisted of two safety valves 2¼ in. in diameter, a float, and glass water-gauge; which latter, however, had been broken a short time previous to the explosion; while there remained on the ground the feed back pressure valve and the feed stop tap.

"The load on the safety valve was stated to have been 70 lb. on the square inch; but the boiler had not been fitted either with a steam pressure gauge or with a tap for applying the indicator, so that no means had existed of checking the actual pressure when the steam was up.

"The rents in the boiler, as well as the flight of the parts consequent on explosion, were extremely complicated, and are difficult clearly to describe. Generally, it may be stated that the shell and internal flue tube had been completely torn asunder one from the other, and that each of the end plants, gusset stays and all, had been wrenched from both shell and tube. To go more into detail. The shell had been rent transversely into two parts, and the longitudinal steam chamber dismantled. The internal flue tube had collapsed and separated into four lengths, fracturing at the ring seams of rivets. The longtitudinal seams which were at the sides of the tube ran in line from one end of it to the other, and the collapse, which is usually vertical, was in this case lateral, and had brought these longitudinal seams from each side of the tube close together. This was the case in each segment of this disjointed tube. The end plates, which had been built in pieces, were separated at each of the seams, and disengaged from the shell and flue tube by shearing both rings of angle iron. One gusset adhered to the end plate, but in the main they were torn away from both end and shell. There were many minor fragments, which were completely curled or crumpled up.

"With regard to the flight of the parts generally, the shell had flown in one direction and the internal flue tube in the other; although this admits of some exception, one portion of the tube being found alongside the shell in a contrary direction to the others. The end plates had also flown in directions opposite one to the other, the fragments of each being scattered a considerable distance apart, and some of them flying to a greater distance than either the flue tube in one direction or the shell in the other.

"The devastation to the surrounding property from the explosion was very considerable, arising greatly from the fact that the heavy portions of the boiler had taken a horizontal raking course, the shell flying into the heart of the works, where it swept the columns, and thus brought down a considerable portion of the roof, and also struck and broke in pieces a heavy rolling mill fly-wheel then in motion. Boilers flying vertically are seldom productive of an equal loss either of life or property. The damage, however, was not confined to that done by the flight of the parts. The percussive action of the steam had shot in every direction the bricks, many of them red hot, from the furnaces previously referred to as built at each end of the boiler. The chimney, about 130 ft. high, was scarred to the top, showing the height to which the parts had been thrown.

"The cause of the explosion was attributed at the inquest to shortness of water, which leading to overheating of the plates had, it was supposed, on the re-introduction of the feed, resulted in a sudden and excessive pressure of steam. This was imputed to the carelessness of the engine tenter, and the jury found him guilty of manslaughter, in consequence of which he was committed to the next assizes for trial.

"There is good reason to question the correctness of the above conclusions, and to attribute the explosion to other causes than shortness of water and the negligence of the engine tenter.

"The pressure of 70 lb. to the inch, at which the safety valves were stated by the manager of the works to have been loaded, was excessive for a boiler of such construction; not so much so for the shell as for the internal flue tube, the latter not being half the strength of the former. This must have been the case even when the boiler was new, and if the tube was perfectly circular; but since then the tube had been repaired, in consequence of overheating, and very frequently a good deal of straining occurs in replacing old plates; also, many tubes are found on actual measurement not to be truly circular, although nominally so; and had this been the case in this instance, its strength would have been considerably less than half that of the shell. In attempting to unravel the complicated rents produced in boilers on explosion, it is important to bear in mind that girder strains and leverages, the amount of which it is difficult to calculate, are induced in the plates as soon as the statical equilibrium is disturbed by the occurrence of a rent. Collapse of flue tubes has been found in other cases to break them up into short lengths at the ring seams, and to sheer the end angle irons through at the roots, as was the case in this instance.

"Upon careful consideration of all the circumstances, to enumerate the whole of which would be tedious, there appears every reason to believe that the explosion resulted from the collapse of the flue tube consequent upon its inherent weakness, and not from shortness of water; while that collapse might have been prevented, either by the introduction at the time of the construction of the boiler, of flanged seams, or hoops of T iron, angle iron, or other approved form, or else by the addition to the flue, since it was made, of angle iron hoops.

"The second explosion, which resulted in the loss of three lives, was of a much simpler character than the one just referred to, and occasioned scarcely any damage to property.

"The boiler was of plain double-flued internally-fired construction, such as is in general use at cotton mills in Lancashire. Its length was 25 ft. 6 in.; the diameter of its shell, 7 ft. 6 in.; and of its internal furnace tubes, 2 ft. 10 in.; the thickness of the plates in both being from three-eighths to seven-sixteenths. The fittings were complete as to number, as well as satisfactory as to condition, and all that was necessary with due care for safe working. The working pressure was stated not to have exceeded thirty-five pounds, and there was no reason to doubt the correctness of this, while the boiler was perfectly capable of working safely at a much higher pressure, as long as it was in good condition.

"On examining the boiler, it was at once apparent that it had not exploded either from excessive pressure or shortness of water, but from thinning of the plates through external corrosion, from which a rent was found to have occurred in the last ring of plates of the shell in the left-hand flue immediately above the brickwork on which the boiler rested, it being set on what are termed side walls. This rent extended longitudinally through the solid of the plate, throughout its whole width, from one ring seam of rivets to the other, but opened only a few inches transversely forming a slot, the edges of which were blown outwards into the form of lips. The plate at this part was reduced by corrosion to the thickness of a sheet of brown paper, and some pieces were broken off with the fingers by one of the jury as specimens. It may be added, that daylight could be distinctly seen through the adjoining plate, which had not been disturbed from its original position by the explosion, but was completely eaten through by corrosion in the form of veins, so that either leakage must have been going on at this part for some time, which, however, it can scarcely be imagined could have escaped detection, or else the plate must have depended on a coating of scale, such as was to be found in other parts of the boiler, for keeping it tight.

"It is unusual for a longitudinal rent in a cylindrical shell to confine itself to such narrow limits as this had done, and the fact is to be attributed to the proximity of the end plate and the lowness of the working pressure.

"The rush of steam and water had blown up the upper part of the brickwork flue, but the boiler was not moved from its place, and no further damage to property appeared to have been done. The loss of life occasioned by the explosion resulted from scalding, the persons killed being in the boiler-room at the time.

"The corrosion which, as previously stated, was external, was caused by damp in the flue, the plates being most seriously affected for a considerable distance along the seating, in addition to the part actually rent. This was at once apparent upon entering the flues, where large cakes of oxide were readily collected. Competent inspection could not have failed to have detected the corrosion and prevented the explosion. The flues were stated to have been swept out about once a year, only, whereas this should be done at least every three months, not only to prevent the loss of fuel that must result from an accumulation of soot, but also in order to afford an opportunity of examining the condition of the plates.

"The present may be a fitting occasion for again urging upon the members of the association the importance of affording the opportunity of making 'internal and thorough' examinations of their boilers. The facts of the second explosion speak for themselves; while in connection with the first, with reference to the collapse of the flues, it may be stated that when these 'thorough' examinations are made, the flues are then gauged in order to check their circular shape; this is too frequently found to vary as much as one or two inches from the truth, which has a considerable influence upon their safety, and may render strengthening hoops necessary where otherwise unsuspected."

PROGRESS DURING THE YEAR 1862.

"The following points have been accomplished during the past year:—

"It is gratifying to find that the members now appreciate more fully than heretofore the importance of annual 'thorough' examinations, and that the number has consequently increased from 434 in the year 1861, to 820 in the year 1862; thus, as it will be seen, having almost doubled this last year as compared with the previous one.

"Still, the privilege afforded by the association is an 'internal and thorough' examination of every boiler once a year, so that the full number has not even yet been attained, and members will not drive that safety from the serivce of the association which they might, until every boiler, without exception, is examined by its inspectors, both 'internally and externally' every year.

"The introduction of 'surface blowing-out' for the removal of incrustation—a difficulty most severely felt in this district, both by inspectors and steam users—has, during the last year, made considerable progress. There are three different kinds of scum-pipes now in use. One entirely free from patent right, and which may be made and applied by any one, and was described in the printed abstract of the monthly report for October last, and two others, both of which are patented, one being termed the 'Needham' and the other the the 'Shepherd' scum-pipe.

"A surface-condenser is being applied to a pair of cotton-mill engines, by which means a constant supply of distilled water for the boilers will be secured. This, in many situations, will prove most valuable, since water, otherwise quite unfit for use, will thus be rendered serviceable.

"Steam-jackets, so long discarded in this district, have been revived and fitted to the cylinders of some new engines lately laid down, while others are being added to a pair of beam engines already in work.

"A superheating apparatus has in two or three cases been applied, for raising the temperature of the steam in its passage between the boiler and the engine.

"Each of these movements has an important bearing upon the economic use of steam in this district, and it is thought that information with regard to them will be highly valuable to the members of the association, and, therefore, the results of the working of the whole will be fully investigated and reported to them. The delay in completing the engines fitted with steam-jackets, consequent upon the depressed state of trade, has prevented their economy being tested during the past year, and with regard to the superheating apparatus, had been in full work for a long period; but the economic result both of the use of the steam-jacket, and of superheating steam, will now be taken into consideration early this year.

"It may be added, that there lies at the office, for the inspection of the members, a drawing of the scum-pipe referred to, as well as the arrangement of feed-apparatus found to be most convenient. Also a drawing of the method of adding strengthening hoops to flues of boilers when in position; from which, through the neglect of suitable precaution, many flues have been injured, and considerable expense incurred by our members. Also there is a drawing of the method of setting boilers found to be most approved with the best proportions of flues. The plans upon which many under inspection are set are most capricious, and defy all attempts to examine the plates.

"A considerable number of 'dimension-sheets' of boilers under inspection have been added during the past year to the previously very numerous stock in the archive of the association. These show the peculiar construction of each boiler taken; and since, in addition, records are kept of their working, and the repairs they are found to require, these records form a valuable reference for members who are intending either to repair old boilers or lay down new ones. A consultation of these at such times would enable one member to profit by the experience of another, indeed by that of the whole number. Thus any repetition of failures would be prevented, while the success of one would prove of advantage to all. It is thought that this branch of the service afforded by the association is of itself of considerable commercial value to steam users, that it must tend, step by step, to the improvement of steam-boilers, and to the completeness of all their arrangements; while such a service could only be rendered by some such system of organization as is to be found in this association.

"L. E. Fletcher, *Chief Engineer.*"
Offices—41, Corporation-street,
Manchester.

HUDSON'S ARMOUR PLATED SHIPS, &c.

The accompanying engravings represent a curious idea for an improved defensive armour for ships, &c., recently patented by Mr. C. Hudson, of Roxbury, U.S.

The object of the invention consists chiefly in the use of certain means, appliances, and arrangements, for the purpose of lessening the percussion of projectiles upon the backing or supports of metallic armour, by the introduction of water between the supports and the protecting armour, and also around its fastenings. This is effected by covering the surfaces exposed to the action of projectiles with a metallic structure, of a cellular form, presenting a strong surface to the action of the projectile, and, from its construction, capable of holding and retaining water within its cells, or between its inner surface and that of the supports or backing. This arrangement, or system of defensive armour, is applicable to all kinds of objects, whether moveable or fixed, on land or water, although chiefly applicable to ships.

The beneficial results to be obtianed from the introduction of water between the armour plates and their supports are based upon two well-known properties of water, its almost total incompressibility, and its power of transmitting force equally and in every direction. The patentee prefers that the water should be distributed, whether within or behind the structure of the armour, in divisions or compartments, so that the destruction of any one division would not materially affect the perfect action of the others.

The arrangement shown at Fig. 1 is formed of hollow blocks, having ribs and flanges for bolting them to the skin of the structure.

Fig. 2 shows an arrangement of tubes: two rows are shown in the engraving, but any number of rows may be used. Fig. 3 illustrates a series of troughs placed between the outer plating and skin. These troughs are intended to strengthen, at the weakest point, the resistance of the plates, and also the frame of the ship, but they also serve to separate the compartments for the water, which may be introduced whenever requisite.

HUDSON'S ARMOUR PLATED SHIPS, &c.

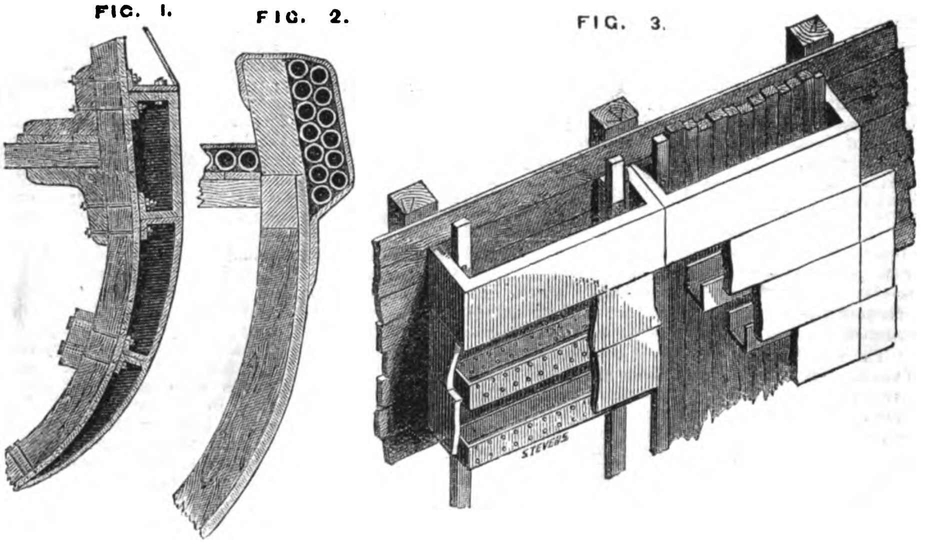


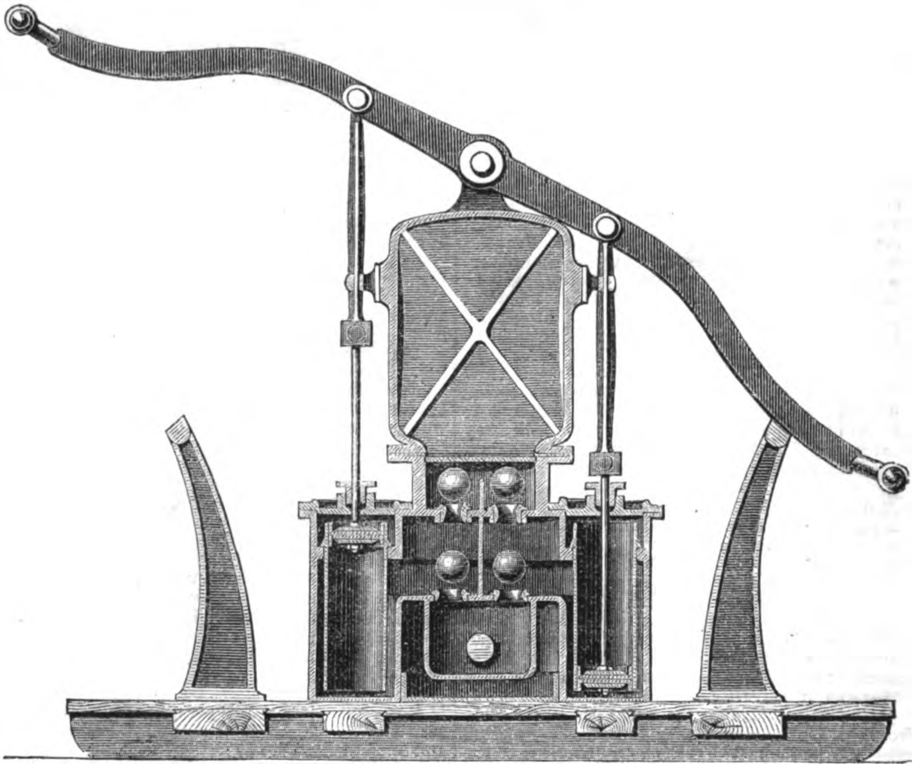
FIG. 1. FIG. 2. FIG. 3.

DELPECH'S PATENT PUMP.

The following is an account of a series of experiments with a new pump, the invention of M. Delpech, of Castres, France. The experiments took place at Nine Elms, in the presence of several scientific and other gentlemen interested. The accompanying engravings represent the arrangement of the various parts.

In appearance, the Delpech pump is not unlike that of a stove, and is susceptible of a horizontal or vertical arrangement. The apparatus consists of a metallic casing divided into two compartments — a cylinder chamber containing the cylinder in which the piston works, and a ball chamber which contains four elastic acting balls as valves or clacks. Both those compartments are again divided into two parts, each portion of the ball chamber, however, communicating with one of the divisions of the cylinder chamber by a free opening. The ball chamber is always in a vertical position. The two balls in the lower compartments are intended for suction, the other two directly over them, in the upper compartments, are intended for forcing the water. These balls rest on bronze seats, and are free in their action, alternately rising and falling with the action of the piston, and therefore alternately opening or closing the orifices which they occupy. The piston is composed of lipped discs of a flexible substance, each having inside a ribbed metal washer. The discs are set back to back in opposite directions and the piston rod passes through them. By this arrangement, again, loss from friction is avoided in the working of the piston. The pump may be used in a horizontal or vertical position, according to the nature of the work to be required from it. The horizontal pump may be fixed on a portable steam or traction engine, and the piston connected with and worked direct from the shaft, thus forming but one machine for draining, irrigation, and especially for extinguishing great fires in towns, docks, arsenals, warehouses, railway stations, and wherever sufficient water can be found to feed it. As a portable pump it may be conveyed on any convenient vehicle, and worked by any convenient motor directly, or by gearing, and when used for draining or irrigation it is inexpensive. It offers facilities as a stationary pump for draining mines and quarries; and on board vessels, especially steamers, it can be placed in the hold, and worked direct from the shaft, being thus protected from shot during action. It may, moreover, be used as a formidable engine of defence on board ship, as boiling water may be projected on a boarding party from a great distance and with destructive effect. M. Delpech claims for his pump an effective power of 70 per

DELPECH'S PATENT PUMP.



cent. of the force exerted; whereas the average power of the ordinary pumps, as proved by dynamometric tests, is below 35 per cent. For example, the vacuum of a Delpech pump, having a cylinder of 9.84 inches diameter, with a stroke of 9.84 inches, attached to a portable steam-engine, would equal 2,696 gallons, and the piston being double acting, there would be a net product of 5,062 gallons for each double stroke of the piston, consequently 50 revolutions would amount to 253 gallons per minute, or 15,180 gallons per hour; and supposing the pump to be supplied at 19,685 ft. below where it is placed, it then would have to raise 4.216 gallons of water per second, representing a power equal to 829.9 lbs. The effective power being 70 per cent. of the power exerted, and one horse-power being equivalent to 550 lbs. of the liquid, raised one foot high per second, it would follow that the pump would require but little more than two horse-power of the portable steam-engine to work it. The air chamber of the pump is arranged to receive two hose and two branch pipes for the same, the hose having .669 of an inch opening; each branch throws out from 120 to 130 gallons of water per minute; so that a fire can be played upon at two places at once by one engine, But, if a single delivery hose only be employed with an .866 of an inch opening, 240 to 260 gallons of water are thrown per minute 160 ft. in height.

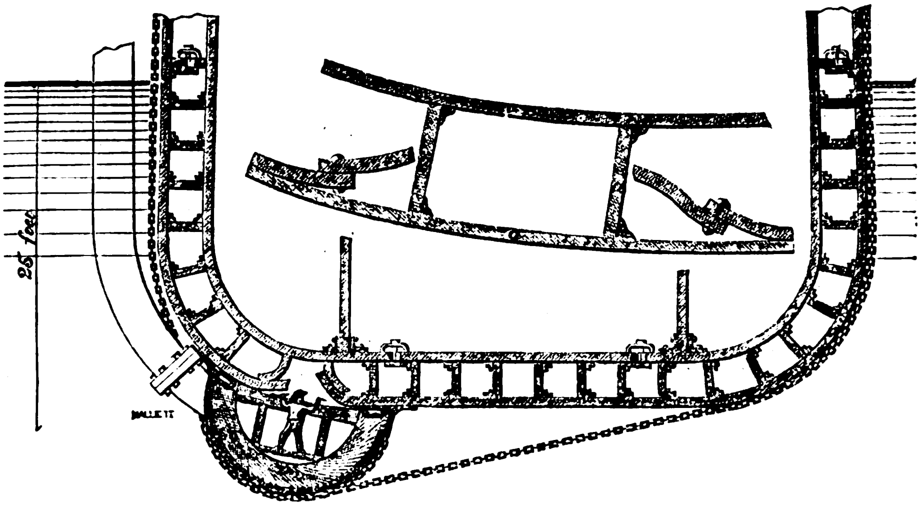
The experiments, though not tried under the most favourable circumstances, were entirely satisfactory. All foreign bodies, not exceeding half the diameter of the suction pipe, will pass through, and if an obstruction does take place from the presence of too large a foreign body, the machinery affords a simple means of removing it with the least possible loss of time. This was proved in the experiment. The distinctive merits, then, claimed for the locomobile pump are that the liquid raised follows a direct course free from all impediment—that it undergoes no interruption of motion from the dead point, which is inevitable in the common system of pumps in use, and avoided in this system by the arrangement of the apparatus, since the instant one ball drops to close its orifice, the other rises to open its orifice—its effective force, in comparison with the power used, as it yields nearly 70 per cent.—the ease with which the pump raises and ejects all kinds of foreign matter mixed with the liquid, without causing any obstruction to its parts, or lessening in the least its delivery, such as ores, cinders, coals, rags, grit, pieces of rope, oakum—in short, all matter whose size does not exceed one-half of the diameter of the suction-pipe.

It is employed in the mercantile marine of France, and has been adopted in the French navy, after a strict competitive examination, conducted by the naval authorities of France. It has also been tried at Woolwich, and a favourable report made of it by the authorities at that establishment.

REPAIRING THE "GREAT EASTERN."

THROUGH the courtesy of Messrs. Howland and Aspinwall, and the personal attention of Capt. Walter Paton, of the "Great Eastern," we are enabled to lay before our readers a full and succinct account of the disaster which befell this celebrated ship, and also details of the plans which were employed to repair her, together with the trials and delays which took place during the progress of this extraordinary feat of hydraulic and mechanical engineering. After the occurrence of the accident (with the history of which our readers are already familiar, from a recent article in the *Scientific American*), a preliminary survey was held, in order to estimate the precise locality and extent of the breakage. This was accomplished by divers, who went under the bottom of the "Great Eastern," and, on returning, reported their observations. They announced that the plates upon the port side were badly damaged, and that the fracture extended a distance of some 12 or 15 feet. Subsequent investigation disclosed the fact, that these figures fell short of the actual injury by some feet.

REPAIRING THE "GREAT EASTERN."



The primary object of the survey being accomplished in ascertaining the nature of the injury, it only remained to invent some method by which it could be remedied. This was not imperatively necessary by any means, as, from the peculiar construction of the ship, eminent engineers declared that, even with this enormous hole in her bottom, she might ride the sea with perfect safety. The anxiety and care of the officers, however, as well as the increased labour to the crew, attendant upon this huge tear in the ship's plating, decided the question; and the work was immediately prosecuted with vigour.

Owing to the huge dimensions of the "Great Eastern,'" and the fact that there is not a dry dock in the world which will admit her, or sustain her immense weight, it will be seen that to repair a damage of this nature, some 25 ft. below the water-line, was an undertaking of no small magnitude. By referring to the section of the vessel, drawn for us by Capt. Paton, which we have had engraved (not however to scale), the precise locality of the fracture can be seen, as well also as the construction of the vessel itself. The character of the damage, and the bearing it has upon the seaworthiness of the "Great Eastern," will be understood by referring to our engraving. The hull is formed of two distinct vessels, as it were, one inside of the other. These skins are stayed to each other by a number of webs or partitions, that divide the vessel transversely into thirty-four spaces; they run the whole length from stem to stern. The webs are further crossed at right angles by thirteen separations, which constitute a system of water-tight cells, each of which is entirely independent of the other, access being had to each cell by man-holes, provided with plates that open into them. It must be borne in mind, also, that there are, inside of the ship proper, two upright iron bulkheads that divide the hull into three long rooms. Now the man-hole plates previously mentioned communicate with each other from the upper series of cells in the ship's broadside down to the foot of the bulkhead before mentioned. There they stop. The arrangement on the other side is, of course, similar. The inner room has two man-hole plates on the inner skin, which allow access to the cellular divisions situated beneath it. These are connected through one another by the same plan as the others. In brief, the "Great Eastern" is a ship built up of a series of rectangular pipes, independent of each other, yet capable of being connected together.

Let us now return to the subject of the disaster. The fracture was entirely through the outer plating of the ship, extending over three of the longitudinal cells, and running fore and aft for a distance of 86 ft. To close up the sides by any other means than with new plates was simply impossible, and these had to be put on while the vessel was in the water at her anchorage. The stubborn broken plates, with their ragged edges, afforded not the slightest hint that could be seized upon to accomplish the work short of much time and labour. Preliminary consultations resulted in deciding the authorities to adopt the expedient of a dam, which should inclose the point of rupture on all sides, and which, by means of pumps, could be freed from water and rendered habitable while the operations were in progress.

It may be inserted here, not inaptly, that the idea of employing such a dam was suggested to Capt. Paton, some time since, by an accident which previously occurred to the "Great Eastern," when going on to the "gridiron" at Milford Haven, England. The accident referred to was the springing-in of one of the plates of the ship's bottom, caused by coming in contact with a log upon which the vessel's weight came when taking her position. Capt. Paton mentioned his plan to the Messrs. Renwick Brothers, the well-known engineers of this city; it was approved of as practical by them, and they then devised the crib herewith described.

The coffer-dam was built of heavy oak timber, semi-circular in form, and planked outside 4 in. thick. It was ascertained that 32 tons of iron would be required to sink the scow, and it was forthwith partially submerged, while two chutes, hereafter mentioned, were affixed. Previously, however, two heavy chains had been attached to each side of it, in such a manner that the cable, fastened on to the larboard side of the dam, was carried under its bottom and rendered up on to the starboard side of the main deck, and *vice versa* in respect to the other cable. From the ends representing the bow and stern of the dam, there also ran large hawsers, which kept it from going adrift in either of those directions. Power was then applied, and the wooden crib hove up against the ship's bottom. Around the parasitic structure were then carried other hawsers and cables, until it was firmly secured in place. Thus far, matters progressed favourably—the dam was in its place, but it was full of water. Two huge chutes, or funnels, which pierced the sub-aqueous box on one side, 10 ft. from the ends, ran up a short distance above the water-line, and furnished the means of reaching the fracture. The edges or gunwale of the dam, must, as will be apparent, be made water-tight, else the pumping might be continued indefinitely, without any result. This it was proposed to accomplish by means of some elastic material; hence, india-rubber, flock mattrass, or substances of a like nature, were suggested for the purpose, but not being available, a plan of the Messrs. Renwick Brothers was put in force.

It occurred to the Brothers Renwick that a water-hose would be just the thing. After the details of its construction, for which we have no room, had been worked up, it was soon applied, and filled all the expectations formed of it. No sooner was the means discovered for obviating one trouble, however, than another appeared. This latter vexation was caused by the difficulty of overcoming the tendency which the hose had to draw in under the compartment. In order to secure it, strips of canvass were attached to one of two battens which armed the gunwale dam; these were carried under and over the hose at intervals, in such a manner that the latter lay in the bight of the former; the flying end was then fixed to the batten again. Upon the outside of the case, or dam, a lappet of Brussels carpet was secured, which the water kept up against the "Great Eastern's" bottom, aiding materially in keeping the sea out; weeds were also thrown into whatever crevices might remain, and the projectors of this ingenious method were rewarded for all their time and trouble by its complete success. To all the unequal surfaces the water-hose opposed its soft and elastic surface, filling up cavities which could not be effectually closed by any other means. The pumps were again tried, and the crib was pumped dry. No sooner was this consummation attained than Capt. Paton descended the chute to the scene of the fracture. Here an extraordinary sight was presented. The vessel was covered with long weeds, and from the cavity in the plates there rushed a waterfall on a small scale; this was perplexing, and was supposed to arise from the fact of some of the valves which communicated with the ship's bottom being open. It was found to proceed from other causes, which were soon remedied. Some water yet remained at the bottom of the box, through which Captain Paton, followed by Peter Falcon, an experienced diver, forced his way, finally emerging at daylight through the other chute. His arrival afforded the best possible assurance of safety to the mechanics who, not unreasonably, hesitated to venture into such an "uncanny" affair. The moral support given to the cause by Capt. Paton's conduct re-assured the doubters, and they prepared to fall in with vigour. It might be expected that here the Fates adverse to this scheme would have been appeased with their former interference; but such is not the case. During the last month, on the occurrence of the violent snow-storm, the great ship dragged her anchors, and parted one of the cables which kept the dam in place. This line immediately, as a matter of course, got about the pump-shaft, which was at that time operated in the sea, and tore it away from its connection, filling the whole dam full again. The pump was then rigged so as to prevent the occurence of a like disaster.

Supposing free access to be had to the fissure, let us examine the nature and character of it. It extended for a distance of 86 ft. in length, by 9 ft. 6 in. at the widest part, narrowing to a point at either end, and was a ghastly wound in the ferruginous cuticle of the monstrous vessel, which, while it did not impair the sea-worthiness of the ship, was of sufficient importance to warrant attention. Three of the cells were broken into, and two of the longitudinal webs upset and sprung out of place for a distance of 10 ft. As it was impossible to add anything to these last-named parts, a plan was put in force whereby the wounded and disunited plates were made one and indivisible again. The diagram will convey an accurate idea of this method. The new plates, *a*, are laid athwart-ship over the fissure, and fastened with hot rivets to the old ones; braces are also annexed, which represent the vertical divisions of the cells. The plates in the vessel's bottom are seven-eighths of an inch thick, but the patch is only five-eighths; it is, however, of the best charcoal boiler iron, and is deemed equivalent in strength to the original structure. Great delay has occurred in getting the new plates in place, for the reason that they could not be supplied by the manufacturers as fast as they were wanted. This trouble has been remedied, like all the others; and we have the satisfaction of announcing, from a personal inspection of the job, that it is completed in a substantial and workmanlike manner. The inside of the dam is very comfortable indeed, and the workmen, we are assured, made no complaints in this respect. They were at work continually, and inasmuch as their labours would have been materially retarded by visitors, no one beside the workmen, not even the ship's officers, were allowed to descend the chute.

The ingenuity and perseverance evinced in adopting this novel apparatus, and making it work practically, is something remarkable; and its projectors, Capt. Paton and the Renwick Brothers, have reason to feel satisfied with it.

Since the above article was written, we have visited the "Great Eastern," and descended into the scow just described. We went through the whole affair without any protection to our garments, and came out unharmed by wet or grease. We must, however—compelled by the inexorable laws of column-rules—omit further details. On this occasion, which was one devised to give the press and the reporting engineers an opportunity of satisfying themselves by occular evidence that the ship was all sound again, Capt. Paton entertained his guests in a hearty and hospitable manner, placing before them on his board the finest viands and wines. At the conclusion of the festivities, a gentleman having proposed the health of Queen Victoria, Capt. Paton responded modestly, and returned, "The President." Various other toasts were given, and the guests dispersed, highly pleased with their cordial, truly British reception. As the steamer which had conveyed the visitors to the vessel steamed away upon her return trip to the city, the band of the ship, stationed on the wheel-house, delicately complimented the disappearing boat with national airs, to which, also, the crew added force, by giving lusty cheers for the Union. Long after the responses which followed these demonstrations had died away in echoes, "the martial strains of the inspiring brass" sent forth "Hail Columbia" and "Yankee Doodle," with a vigour that excited the most lively enthusiasm for, not only the compliment which was conveyed, but also the hospitable entertainer, Capt. Paton.

A series of resolutions highly complimentary to Capt. Paton and the Messrs. Renwick Brothers, were passed by the guests on their return to the city, which we are compelled to omit.—*Scientific American.*

Meetings for the Week.

MON.—*Royal Inst. British Architects*, at 8 p.m.
London Inst., "On Sculpture," by R. Westmacott, Esq., at 7 p.m.
Royal Geographical Soc., Sir R. Murchison in the chair. 1, "Ocean Currents on the N.E. Coast of South America," by J. A. Niann, Esq. 2, "Ocean Telegraphy," by Captain Powett. 3, "Survey of the Atlantic, with regard to Telegraphic Communication with Europe and America," by G. C. Wallich, Esq., M.D., at 7.30 p.m.
TUES.—*Inst. Civil Engineers*, "On Railway Telegraphs, and the Application of Electricity to the Signalling and Working of Trains," by W. H. Preece, Esq., at 8 p.m.
WED.—*Soc. of Arts*, "On Photography and the Magic Lantern, Educationally Considered," by S. Highley, Esq., at 8 p.m.
London Inst., "On Commercial Law," by G. W. Hastings, Esq., at 7 p.m.
THUR.—*Royal Soc.*, at 8.30 p.m.
Chemical, at 8. p.m.
Antiquaries, at 8.30 p.m.
Linnean, at 8 p.m.
FRI. —*Architectural Assoc.*, "Class of Design, Street Lamp."
London Inst., "On the Chemistry of the Non-Metallic Elements," by F. Field, Esq., at 7 p.m.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our Correspondents.*]

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The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to M. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 6 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of his good faith.

TO CORRESPONDENTS.

RECEIVED.—Capt. C. C., W. A., G. C., N. C., J. M. D., C. B. (thanks).

FRED. (Lincoln).—Double shrinkage must be allowed for the original wooden pattern, in forming a pattern of cast iron.

S. M.—You would have to enter upon a recondite business at 26 years of age, in which most men have made a beginning at 16.

J. S.—You can get the railway report by ordering it through any bookseller.

M. P.—It will appear next week.

TENSILE STRENGTH OF IRON.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In support of Mr. Kirkaldy's conclusion, No. 18, and in answer to your correspondent "Ignoramus," allow me to refer the latter to an experiment cited in a short paper by myself, "On the Structural Changes in Iron from Vibration and Concussion," which appeared in your Magazine vol. 51, page 561.

The same experiment is also mentioned in one of your volumes for the year 1847, (vol. 47, page 626). I have repeated it many times since, and it proves conclusively to my mind that the appearance of the fracture of iron varies according to the method of breakage.

I am, &c.,
JAMES ROCK.

Hastings, January 4th, 1863.

Gossip.

A new permanent bridge, connecting the North and South Camps at Aldershott, has just been opened, replacing the pontoon bridge over the Basingstoke canal, which has been a source of many melancholy accidents. The bridge has been constructed by the 10th and 24th companies of the Royal Engineers, stationed in camp. It is situated parallel to E, F, G, and H Lines, North Camp, by which it is connected by a splendid road across the heath, the work of the convicts at the military prison. The bridge is constructed of iron girders, supporting a wooden framework, with a raised footway on each side, leaving a roadway of 18 ft. for carriages. By its means access to either camp will be more direct.

It is said that Messrs. Jones and Quiggin, of Liverpool, will shortly launch a steamer of 250 tons burthen, built of steel plates only 3-16ths of an in. in thickness. The Liverpool *Journal of Commerce* states that she is intended for a "peculiar trade." and that she will steam 20 knots an hour.

Mr James Bruce has succeeded in determining the influence of electricity in promoting the growth of seeds, roots, &c., which have been made to germinate in less than ten hours, by placing them in a zinc cup fitting into a tin-cup, and placed in a basin holding the acid bath.

At the last meeting of the Council of the British Horological Institute, Mr. Hislop exhibited some specimens of ten per cent. aluminium bronse, with the view of showing its qualities in relation to oxidation or tarnishing. It has been stated that it scarcely tarnishes at all in ordinary atmospheres, and if it does, it does so slowly. The specimens shown had been polished but a few hours, but they exhibited very decided marks of tarnishing, although only exposed to the ordinary atmosphere of a town. The actual amount of oxidation was considerably more than would have been shown by hard rolled or hammered brass in the same period of time. The use of this compound metal has been recommended for the fine work of watches and chronometers, as not requiring gilding, because it does not tarnish, but the facts do not appear to be exactly in accordance with what has been stated. Moreover, if the metal tarnishes so readily, what would be the probable effect of the oil applied for lubrication of the surfaces?

According to the *New York Tribune*, in the week before Christmas there were 520 presses, "in full blast," making postal currency.

The next general meeting of the members of the South Wales Institute of Engineers will be held at the Castle Assembly Room, Merthyr Tydvil, on Wednesday, Jan. 14. The chair will be taken at 12 o'clock noon. The following papers, read at former meetings, will be discussed:—Mr. Cox's, "On the Selection and Treatment of Coal for the Blast Furnace and Cupola;" Mr. Parry's, "On

Puddled Steel;" Mr. H. T. James's, "On Mining in the County of Leitrim;" Mr. Waring's, "On Coal-cutting Machinery." And the following papers will be read and discussed:—"On the Selection and Value of Coke," by Mr. Child; "On Long-work," by Mr. Hedley; "On Boiler Explosions," by Mr. M. Jones. The Council Meeting will be at 11 a.m.

Another important addition was made on Tuesday to the Royal Navy by the launch of her Majesty's iron screw steam vessel, "Tamar," of 2,811 tons, and 500-horse power, from the premises of the builders, Messrs. Samuda, Poplar. There was a large number of spectators. After launching the vessel was taken in tow, and hauled into the East India Docks, under the mast-house, where she will be fitted with her screw machinery and engines, manufactured by Messrs. Ravenhill, Salkeld, and Co. The "Tamar" was laid down in November, 1861, and is in every respect a fine vessel. The following are her principal dimensions:—Length, 300 ft.; breadth, 44 ft. 7 in.; depth in hold, 34 ft.; burden in tons, 2,811 82-94 old measurement. After receiving her machinery she will be removed to Woolwich Dockyard to be rigged and fitted with her armament, consisting of four rifled guns, and she is expected to be ready for service by April next. A large number of workmen are now employed at the premises of Messrs. Samuda upon the construction of her Majesty's armour-plated screw cupola ship "Prince Albert." She will be iron-cased throughout with 4½ in. plates, and fitted with four armour-cased shields or cupolas, of immense strength, upon Capt. Coles's plan, recently adopted by the Admiralty. She is the first cupola ship laid down for the Government, and is named the "Prince Albert" by express desire of her Majesty. The armament of this magnificent vessel will consist of eight monster rifled guns, two of which will be fitted in each cupola.

The Universal Private Telegraph Company have issued a new prospectus in consequence of the Board having been strengthened by some Manchester names. The company is already in operation, more than 2,000 of their 7,600 shares, of £25 each, having been originally subscribed. The remainder are now offered to the public.

It appears that the business recently carried on by Messrs. Mare and Co., of Millwall, is now under the superintendence of a limited liability company. We find from the *Army and Navy Gazette* that there is considerable activity on the premises. In the ship-yard there are building, the Government frigate "Northumberland," armour-plated, 50 guns, 1,350-horse power, 6,626 tons; P. and O. screw steam ship, 400-horse power, 2,300 tons; Italian cupola ship, armour-plated, 700-horse power, 2,300 tons; Spanish iron-cased frigate, armour-plated, 1,000-horse power, 4,800 tons; three iron sailing ships, 1,000 tons each, 3,000 tons; one iron paddle steamer for the opium trade, 230-horse power, 900 tons; and two paddle steamers, 800 tons and 1,000 tons, have just been contracted for, and are about to be laid down; total, 21,726 tons. In addition, in the rolling mill department, the massive iron work (wrought iron caisson) for the new Blackfriars Bridge is in a state of forwardness, and so are a considerable number of bridges for the Metropolitan and Kent Coast Railway. The plates for the cupolas of the "Royal Sovereign," and the plates for a target ordered by the Government on Mr. George Clarke's principle, with the heavy armour-plates in preparation for the "Northumberland," keep the mills in very active work. The forge consists of 10 steam hammers, capable of turning out all descriptions of wrought iron forgings up to 60 tons each piece. The bar mill rolls angle iron, flat, round, square, and all descriptions of heavy bar iron. The plate mill is capable of making boiler plates and ship plates up to 2 tons each plate; also fortification bars of equal weight. The armour-plate mill, rapidly approaching completion, will be the largest mill in Europe, and its capabilities will far exceed anything that has been hitherto attempted. This mill will be capable of rolling armour plates 12 inches thick, up to 20 tons each plate, as well as rounds and squares up to 18 inches. In order that these mills may be enabled to turn out a maximum quantity of finished iron ready for the market, a roughing mill has been erected to prepare the rough bars, tops and bottoms, &c., &c., necessary for the finishing mills. All the forgings in connection with the iron-clad frigate "Northumberland," as well as the heaviest of those for the "Minotaur," have been made here. The iron for the Inglis target, as well as the target itself, which stood so successfully at the late trial, was also manufactured in these works.

Centrifugal Pumps.—The following letter has been addressed to the Admiralty. As Mr. Colburn's report is nearly the same as that published on the 5th ult. in the *Engineer*, we may observe that circumstances have transpired which render it proper that the letter should appear in our columns:—"My Lords,—Trials of the large centrifugal pumps in the late International Exhibition were made early in November last by myself and by Mr. D. K. Clark. Mr. Clark has stated that "he acted for the Admiralty in the matter," and he has pronounced my report upon the trials to be erroneous. I deem it as much my duty as just to myself to state to your lordships that if Mr. Clark has made any report upon the trials in question, materially at variance with my own report (a copy of which has been laid before Colonel Greene, one of your lordships' officers), then such report by Mr. Clark is erroneous, and I hereby protest against its conclusions. I hold myself ready, on the production of such report by Mr. Clark, to point out the errors it may contain.—I am, my lords, your lordships' obedient, humble servant, Zerah Colburn, 76, Gower-street, Bedford-square, December 29th, 1862."—*The Engineer.*

Iron-clad Men.—It has been suggested in America, in view of the improvements which are daily carried out in iron-clad ships and batteries, that the same principal might be applied to their crews, or to infantry in the field. Some steps have already been made in this direction, and life-preserving vests have been sold, we believe, in great numbers. Why, then, can we not sheath the human body so that it will be perfectly protected, against rifle balls at least, and yet, at the same time, preserve its elasticity and activity unimpaired? The force of a bullet, stopped in mid career, would doubtless make the iron or steel-clad recipient wink, if it did not entirely destroy his centre of gravity, but we think most of our sharpshooters would gladly exchange the possibility of being stunned or even stricken senseless for a time, for the certainty of being killed outright without such protection. The ancient men-at-arms wore suits of mail, but they weighed down both horse and rider, and had to be abandoned. We ourselves know an Austrian inventor who was successful in making an india-rubber breast plate. He stood the fire of the old fashioned musket with safety, but found himself much bruised after the trials.

The Inventor of the Fire-escape, Abraham Wivell.—Wivell now took to scheming dreaming, some of his friends said. He proposed a plan for draining London independently of the Thames; for, said he, if all the sewers drain into the Thames. the Thames itself must become one great sewer. But this scheme fell to the ground; it was too far in advance of the times. His fire-escape was more successful; but, poor fellow, how sedulously he worked at his idea, and what time and money he spent before the design of his brain was embodied in tangible wood and iron! His first escape consisted of a rope, fastened in the inside wall of the upper storey of the house, and a belt, which was to be girded around the body of the person escaping, and was also to be attached to the rope. With such an apparatus Wivell frequently descended from the topmost room of his house, to the wonder of the surrounding neighbourhood. Although he had demonstrated the practicability of this plan of escape, people were slow to adopt it, and further thought led to the production of the well-known fire-escape, now happily found at the convergence of most of our principal London thoroughfares. Even after he had completed his escape, he could not, for a long time, get any help in bringing it out. But he was enthusiastic and persevering; and he at length succeeded in calling a public meeting, when he explained his plan in detail. The formation of a committee was the result of the meeting, and Wivell was awarded with the expenses of his escape, and—a gratuity of £10! Ultimately the Royal Society for the Protection of Life from Fire was formed, and Wivell's invention was adopted—*Social Science Review.*

Academy of Sciences.—The following are the prize questions proposed by this body at its last great annual meeting:—1. Mathematics.—To discuss with care the observations of tides made in the principal ports of France, and compare them to the theory (3,000f., papers to be sent in before the 1st of June, 1865); to re-examine the phenomena of capillarity, and compare them to the results of calculation (3000f., 1st April, 1864); to improve the geometrical theory of polyhedrons (3,000f., 1st of January, 1864); to establish a complete and rigorous theory concerning the equilibrium of floating bodies (3,000f., 1st July, 1864). 2. Mechanics.—To introduce some important improvement in the application of steam to the Imperial navy (6,000f., 1st of Nov., 1863). 3. Bordin Prizes.—On some questions of optics, at the candidate's choice (3,000f., 1st of July, 1864). To determine the direction and relative intensities of electric currents produced by various thermo-electrical substances (3,000f., 1st of July, 1864). To effect some improvement in the mechanical theory of heat (3,000f., 1st of July, 1864). 4. Natural Philosophy.—On the comparative anatomy of the nervous system of fish (3,000f., 1st of September, 1864). To study the changes effected during germination in the constitution of the tissues of the embryo and perisperm (3,300f., 1st of April, 1864). On the production of hybrid animals by means of artificial fecundation (3,300f., 31st of Sept., 1863). 5. Medicine.—To trace the history of Pellagra (5 000f., 1st of April, 1864). 6. Medicine and Surgery.—On the application of electricity to therapeutics (5,000f., 1st of April, 1866). 7. Surgery.—On the preservation of members by preserving the periosteum (the Academy offers 10,000f.; the Emperor also 10,000 f., 1st of April, 1866). 8. Bordin prizes of 3,000f. each, to be sent in before the 31st of December, 1863:—On the distribution of the vessels of the latex in the organs of plants; on the anatomical history of coral and other zoophytes of the same family; on the structure of the stems of plants, with a view to determine their respective families.

Trials of Mr. Bray's Traction Engine.—A series of trials was commenced on Tuesday last week in Woolwich dockyard with Bray's traction engine, in the presence of the Commodore-Superintendent and the officials of the yard. The engine is intended to supersede horse-labour for the ordinary work of the yard. It was exhibited in the Great Exhibition, where it was awarded two prize medals in classes 8 and 9 for practical utility. One of the boilers for the "Caledonia," weighing 28 tons, was placed on a truck, and attached to the engine, which drew it about the yard with perfect ease. The engine then went to the foundry, where a load, consisting of a plate weighing 16 tons 15 cwt., was drawn by it to the factory travelling crane, and here two other plates were put on the truck, each weighing about 18 tons, bringing up the load to over 30 tons. With this the engine went several times round the yard, turning the sharpest corners without any difficulty, with only one driving wheel in gear. The engine was then uncoupled, and run up and down the yard without any load being attached. The speed attained was equal to 10 miles an hour. It was tried over the rough paving, the soft ground, and the trams, and answered equally well on each. The day's proceedings terminated by conveying an old boiler, weighing 22 tons, from the foundry-yard to the iron-yard. On the following day the engine commenced by taking a load of about 20 tons of loam-plates from the foundry to the iron-yard. It had to take this load in and out and around the various iron stacks in the yard. This it did without any difficulty. It returned to the factory, and the sheer-legs were fitted to the engine, when it lifted the screw propeller of her Majesty's ship "Racer," which it took to, and brought back from, the weigh-bridge. The weight was ascertained to be 2 tons 1 cwt. 2 qrs. It then steamed on to the armour-plate shed, and drove, by means of the drum fitted for transmitting power, the hydraulic pumps used for working the press for bending the 4½ inch armour-plates for the "Caledonia," some of which were bent to the required extent by the power transmitted by the engine. Yesterday the experiments were continued, and the engine was tried as a steam fire-engine with equal success. The diameter of the cylinder is 7 in.; the length of stroke, 10 in.; the working pressure of the steam, 120 lb.; the gearing, 21 slow speed and 71 quick speed; the weight of engine complete, with fuel and water, is about 12 tons. It is fitted with link motion and reversing gear, feed and tank (hot and cold water) pumps, the latter being a double-action 5 in.

bore, worked direct from the piston through the cylinder bottom; Giffard's injector, sheer-legs, and a barrel for hoisting, a drum for driving machinery, a winch end for a fall rope or tackle, &c. The wheels and steering gear and general arrangement of the engine are on the company's patent principle, the steering being effected by means of a worm working in the segmental rack. The driving-wheels have inner and outer bearings, and the engine is mounted on inner and outer springs on each side of the driving wheels, while the fire-carriage is also mounted on a strong steel spring. The gearing is throughout of the best malleable cast-iron, and the driving wheels are of wrought iron. The machinery is cased in by a light iron casing, which at the end is formed into bunkers, wherein can be carried about 12 cwt. of fuel, while the tanks contain about 400 gallons of water. The engines and all the machinery are attached to a framing independent of the boiler, which is of the horizontal tubular description, made throughout of the best Lowmoor iron.—*Times.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 1705, 1713.
BOILERS AND FURNACES, 1734.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 1730, 1756.
SHIPS AND BOATS, including their fittings, 1728, 1736, 1758, 1763.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 1731, 1732, 1744.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 1716.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1707, 1708, 1715, 1719, 1723, 1726, 1738, 1741.
BUILDINGS AND BUILDING MATERIALS, 1704, 1714, 1727, 1757.
LIGHTING, HEATING, AND VENTILATING, 1718, 1721, 1722, 1729, 1751.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1703, 1709, 1706, 1737, 1742, 1753, 1759, 1760.
METALS, including apparatus for their manufacture, 1743. 1752.
CHEMISTRY AND PHOTOGRAPHY, 1712, 1717, 1724.
ELECTRICAL APPARATUS *none.*
WARFARE, 1710, 1754, 1761.
LETTER-PRESS PRINTING—*none.*
MISCELLANEOUS, 1701, 1702, 1711, 1720, 1725, 1733, 1745, 1747, 1749 1755.

1697. J. HEATLEY and J. TANGYE. *An improvement or improvements in lifting jacks.* Dated June 5, 1862.

The frame of this jack is rectangular in cross section, being made of bars or plates of iron rivetted together. In the said frame the ram of the jack, which is made in the form of a rack, slides. The bottom of the said ram or rack has a claw or foot which may be placed under the article to be raised. The said ram or rack is raised and maintained in its raised position in the following manner:—At the top of the jack a lever is situated, jointed by means of links to the upper end of the frame. The short end of this lever can be made to engage with and be disengaged from the teeth of the before-mentioned rack, the said end of the lever being rounded so as to fit in the said teeth. The short end of the lever being engaged with one of the teeth of the rack, its longer arm is depressed, and the rack or ram is raised by the said short end of the lever a distance equal to the pitch of the rack. The lever is then released from the rack, and its end made to engage with a tooth of the rack next below that with which it was first engaged, and the rack or ram is again raised, and so on till the article has been raised the required height. The ram or rack is maintained in its raised position after the disengagement of the lever from the rack, by means of a self-acting lever or catch below the raising lever. *Patent abandoned.*

1698. R. SILL. *An improvement or improvements in attaching direction cards, name plates, or other cards or plates to trunks, packing cases, and other articles.* Dated June 5, 1862.

In carrying out this invention the inventor affixes to the surface of the trunk or case or other article, a frame of thin metal, the said frame being, by preference, rectangular and closed on three sides. The said frame is attached to the surface of the trunk, case, or article, by means of screws, pins, or rivets. The direction card or plate is inserted in the open side of the frame, and is passed by a sliding motion into grooves in the frame, so as to fill up the open space in the frame. The direction, or inscription, or device on the card or plate is thus displayed in the said frame. The card or plate is prevented from being removed from the frame by means of a screw pin, which is passed through a hole in the middle of the open side of the frame, the head of the pin resting on the top of the frame, and being nearly flush therewith, and the screwed end of the pin passing through the part of the trunk or other article to which the frame is attached. A screw nut being screwed on the end of the pin, it is secured in its place, and the card or plate fixed in the frame. *Patent abandoned.*

1700. W. ROWE. *An improved forge and bellows.* Dated June 5, 1862.

This invention consists in the application to the bed plate of a forge of a supplemental or under plate, leaving a space between the two for the circulation of the air, in order to keep the under plate cool, and to prevent the top of the bellows from becoming burnt or injured by the heat of the forge fire above it. Also in the application of a supplementary or top-plate to the bellows, leaving a space for the circulation of air, so that the plate, when raised to its uppermost position, shall protect the upper plate of the bellows from injury by the heat of the forge. *Patent abandoned.*

1701. E. CONROY. *Improved machinery for cutting corks, bungs, and such like articles.* Dated June 5, 1862.

This consists in the use of a knife made to traverse horizontally on V guides by a crank and connecting rod, worked by the main shaft of the machine. Under this traversing knife the rough piece of cork is fed, and is supported by a bed and stop in the framing of the machine. The width of the strip to be cut off is determined by an adjustable stop, caused to traverse to and from the knife by a tappet, to allow the separated length to fall into a receptacle. The lengths to be cut into quarters are then subjected to the action of a number of revolving knives mounted upon a screwed shaft, having nuts or washers between the knives. The knives are caused to revolve with the shaft by a feather or projecting lip. The shaft is mounted in journals on the framing, and receives motion by gearing from the main shaft. To receive the length to be quartered, and to hold them during the action of the knives, a revolving bed is provided, and is supported in journals on the framing of the machine in front of the knives. The bed is provided with a comb-front for the passage of the knives through it, and receives a rocking motion from a cam on the knife shaft for throwing off the piece of cork which has been cut into quarters by the passage of the knives. The knives used for quartering may be differently mounted and actuated, so as to be free from the compressing action of the revolving knives. *Patent completed.*

1702. G. HADFIELD. *Improvements in the manufacture of casks or barrels, and in the machinery and apparatus to be used in the construction of the same.* Dated June 5, 1862.

This invention is not described apart from the drawings *Patent completed.*

1703. W. E. NEWTON. *Improvements in the construction of organs and other wind instruments, parts of which improvements are also applicable for regulating the pressure and flow of gas and air.* (A communication.) Dated June 5, 1862.

This relates, 1, to a novel construction or arrangement of parts, whereby the pressure of the air in the different parts of the instrument may be regulated. 2, To a novel or improved construction of single or double action pneumatic motor, applied to the keyboard or action of the instrument, for the purpose of rendering the power required to be exerted by the player to produce the notes. *Patent completed.*

1704. J. VERITY. *An improved composition for coating and preserving walls, or other exposed surfaces.* Dated June 6, 1862.

Here the inventor takes one bushel of quick or grey lime, which he mixes with 28 gallons of water, and, whilst the liquid lime is in a warm state, he adds either 20 lbs. of common salt, rock salt, or any analogous substance, which, after being well mixed and allowed to cool, is strained through a fine sieve; any of the ordinary colouring materials to produce the required shade may be added. The compound, when thus prepared, is ready for immediate use. *Patent abandoned.*

1705. E. DEATH. *Improvements in road locomotives or traction engines.* Dated June 6, 1862.

This consists, 1, in fixing the engine or engines on a bed plate connected to square plates at each end of the boiler, thereby obviating the present liability of the bearings and joints to become affected by the expansion of the boiler, and also admitting of the engine or engines being radially disconnected from the boiler when required. 2, In mounting the axle in two side plates, extending from end to end of the boiler, and fixed to the square end plates thereof, for the purpose of preventing the liability of the axles to become heated by contact with the boiler. 3, In forming the axle with journals working in bearings between the side plates and the wheels, which bearings are fixed to a frame extending the whole length of the engine. By this arrangement the said journals of the axle are made to form two pivots, in which the hinder part of the frame rests, when the front end of the boiler is raised or lowered by a screw and levers, or other lifting apparatus applied thereto. 4, In applying the power for turning a single steering wheel at or near to the axle, instead of above the top of the wheel, as usual. 5, In constructing the side or end framing, or both, in the form of hollow tubes, for the purpose of carrying water, so as to dispense with the use of a tank or tanks for the same purpose. *Patent abandoned.*

1706. G. DARLINSON. *Improvements in the manufacture of ribbons.* Dated June 6, 1862.

In addition to warp of the ordinary kind, which is used and woven together in the usual way, whether to produce a plain or figured ribbon, the inventor uses as part of the warp of the improved ribbons, whether plain or figured, a certain quantity of chenille or narrow velvet, either plain edged, or stamped. The chenilles or velvets are passed through the harness and sley of the loom, and are caused by the usual means to work into the fabric of the ribbon, or to float on the face of the same, or upon the back, or to become attached to its edge, as may be necessary to produce the effect desired, viz., a pattern produced by the appearance in the required places of the chenille or velvet on a pileless ground. *Patent abandoned.*

1707. W. R. JEUNE. *Improvements in the manufacture of fabrics suitable to be used as substitutes for solid leather.* Dated June 6, 1862.

Here the inventor takes a long sheet of fabric, felt, or paper; a strong calico, or a linen fabric, or a stout paper, he finds suitable. He spreads thereon a coating of india-rubber or gutta percha, or such like solution. The solution may be applied by a spreading machine, such as is commonly used in spreading india-rubber solution on fabrics to produce a waterproof material. When the solvent of the solution is evaporated by rolls, heated by steam or otherwise, a thin film of rubber or gutta percha is evenly deposited on the fabric, felt, or paper. He next applies a similar coating of india-rubber or gutta percha solution upon a number of skins or pieces of leather; and when the solvent is evaporated by the aid of iron rolls, he unites the skins or pieces of leather and fabric, felt, or paper, by passing them through the rolls with the prepared surfaces in contact, the rolls being so set as to press the skin or pieces of leather and the fabric, felt, or paper, firmly together. The fabric, felt, or paper, and skins, or pieces of leather, now united, are rolled upon a drum, and placed upon a machine in which, whilst the sheet is kept at the required tension, a knife running at a quick speed splits off as much of the skin or leather as may be required. *Patent completed.*

1708. A. V. NEWTON. *Improvements in knitting machinery.* (A communication.) Dated June 6, 1862.

The patentee claims, 1, a pad of india-rubber or other yielding material, applied and operating in combination with the needle ring or needle bar, and needles of a knitting machine, in the manner and for the purposes set forth. 2, The use in combination with the pad above mentioned of a second pad, so applied as to press upon the work just before the first mentioned pad leaves it, and continue holding it against the needle ring or needle bar while the first one is raised, as described. 3, The use in a circular knitting machine of a presser divided into two or more pieces or sections, having independent movements, substantially as specified. Lastly, the stop motion, composed principally or in part of slides suspended from the yarns, and a threaded rotating and longitudinal moving shaft or notched reciprocating bar, or their equivalent, applied in combination with the driving shaft and driving pulley of a properly organised knitting machine, to operate as set forth. *Patent completed.*

1709. W. HARDING. *Improvements in the manufacture of bonnet fronts, and in apparatus to be employed therein.* Dated June 7, 1862.

This invention has for its object the manufacture of bonnet fronts, with the view of producing the same at less cost and labour, as also to admit of the pattern or design being more advantageously varied than at present, and consists in causing the pleatings or gofferings forming the said fronts to be produced in a cold state through the medium of shapes or moulds of wood, metal, or otherwise, in such manner as to admit of the blond, lace, or other material, being conveniently threaded through, or passed round, the same, and held or retained in position suitable for being banded and finished in the ordinary manner. *Patent completed.*

1710. A. J. ADAMS. *Improvements in firearms.* Dated June 7, 1862.

The object here is to reduce the windage, and, at the same time, get a larger missile, or projectile, into the bore of a firearm of any calibre, and the patentee effects this object by a combination of ratchet wheels, or eccentric grooves, with rounded angles, and of angular grooves in the "lands," sometimes modifying the same combination by rounding all the angles. *Patent completed.*

1711. G. D. HATTON. *Improvements in presses.* Dated June 7, 1862.

This improved machine is an upright press for "nipping" or pressing purposes. The patentee uses two standards or upright pillars, with a broad foot to each, to give a firm support; these standards are attached at their summit by a cross beam, through which works a screw terminated by a lever and ball of considerable power, and supporting a plate which forms the upper flat of the press. The sides of the pillars are shouldered or grooved at distances of about 3 in. apart, commencing from near the base, and meeting the plate before named, at the greatest fall of the screw. A loose flat, or plate, of similar dimensions to the upper one before named, is placed upon one or other pair of shoulders, or grooves, of the standards or uprights according to the thickness of the matters to be pressed, so that the faces of the two plates enable articles of various thicknesses to be pressed by a short screw, and thereby avoid the loss of time and wear and tear of packing, or of causing a long screw to descend to the lower part of the press, when a thin substance is to be acted upon. *Patent completed.*

1712. G. HASELTINE. *A new and improved photographic camera.* (A communication.) Dated June 7, 1862.

The patentee claims, 1, a negative plate or bath holder, having a hollow journal, channel, and throat, constructed and operating substantially as and for the purposes described. 2, The hollow journal described for introducing and withdrawing the baths. 3, A double channel tubes and funnels, constructed, and operating substantially as, and for the purposes, described. 4, The combination of negative plate and bath holder, having a hollow journal and throat as one instrument, with the crooked stem funnel, constructed, and operating substantially, as described. 5, Giving the combined negative plate and bath holder the capacity of assuming horizontal and perpendicular positions at will, as described. 6, The combination of camera box, crooked stem, funnel, hollow journal, channel, and throat, and fluid tight holder, as described. *Patent completed.*

1713. C. HOOK. *Improvements in the construction of steam-engines.* Dated June 7, 1862.

This consists in forming an oscillating engine which regulates the introduction and omission of the steam or other motive power by the motion of the cylinder, thus obviating or avoiding the necessity of a slide-valve. To effect this, the patentee forms in the one bearing, or support of the cylinder, two passages connected with the steam pipe; and in the trunnions of the cylinder casts corresponding holes or passages, so that the apertures in the trunnions of the cylinder coincide with those in the bearing or support. In the opposite trunnion he forms two passages which serve as the exhaust, the waste steam after being used passing down the interior of the support to the exhaust pipe. The next part of the invention relates to the cock or valve which regulates the introduction of the steam to the cylinder. This he makes of a circular form, hollowed out on two sides, by which, when turned obliquely to the right or left. the steam is admitted or allowed to enter one passage of the cylinder, which admits the steam into the bottom of the cylinder, and urges the engine forward. To reverse the engine the cock is turned in the opposite direction, the steam is admitted through the opposite port into the cylinder, above the piston, which thus changes the direction. When the handle of the cock is turned quite straight, both passages are closed, and the engine will be at rest. *Patent completed.*

1714. J. Lovegrove. *Improvements in apparatus for inspecting small sewers and drains, and for facilitating the removal of obstructions therein.* Dated June 9, 1862.

In constructing, ventilating, inspection, or flushing shafts, at intervals, over small drains and sewers, they are constructed from the top of the sewer to the surface of the ground partly vertical, and partly curved, and also in two divisions, for a double shaft, so as to admit the passage of a bamboo cane (screwed together in short lengths) down one division of the shaft, turning into and along the sewer towards the outlet for any distance, and thereby effecting the removal of any obstruction between the shaft and the distance reached; also down the second division of the shaft, turning into and along the drain towards its terminal end for any distance. The shaft is covered with a marked box, adapted either for carriage or foot roadways, that can easily be opened, or lifted off, without breaking the ground. *Patent completed.*

1715. W. H. Turner. *Improvements in engines for carding cotton and other fibrous materials.* Dated June 9, 1862.

This consists in placing under the "licker in" cylinder a number of grate bars of varied angular shapes. The tops of these bars are formed so that, when in their places, they appear like the teeth of a circular saw inverted, but having spaces between them which gradually widen towards the bottom. At various intervals the bars are formed of different angles. *Patent abandoned.*

1716. A. Ford. *An improved method of protecting beer and other fluids from the direct action of atmospheric air.* Dated June 9, 1862.

Here the inventor places within a cask or vessel, or any appliance of any kind capable of protecting the beer or other fluid, a sac or cylinder of a light, flacid, waterproof material, or air-tight substance, having one end fixed to the corresponding end or head of the cask or vessel, and having one or more apertures corresponding to the bung hole, or tap hole respectively, the edges of such opening or openings in the sac or cylinder being elongated outwards, so as to overlap the edges of the corresponding opening or openings in the cask or vessel. The other end and sides of the sac or cylinder are to be fixed or not to the cask or vessel, as experience may determine, but calculated to fulfil the objects of the invention. He then places the fluid to be protected within such sac or cylinder, allowing the air admitted through an opening or openings in the cask or vessel to act only on the outer surface of such sac or cylinder, thereby adapting it to the contained fluid, and keeping up the necessary pressure to secure the due ejection of such fluid. *Patent abandoned.*

1717. E. Hottin. *Preventing stuffs and woodwork from igniting.* Dated June 9, 1862.

This composition contains three products, of which salt of tartar is the base, the two others being starch and sulphate of soda. *Patent abandoned.*

1718. J. Keeling. *Improvements in apparatus for the manufacture of gas.* Dated June 9, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1719 J. M. Ryo-Catteau. *Improvements in machinery for twisting wool, cotton, flax, silk, and other fibrous threads.* Dated June 9, 1862.

To effect the objects of this invention, the patentee mounts on a frame or stand a spindle carrying the cotton or fibrous material to be twisted, to which he communicates a rotating motion by a drum connected with it by a band. By these means he gives the thread the first twist; after leaving the reel or bobbin, the thread is passed between two drawing cylinders or rollers, over one of which the thread is wrapped; from these cylinders, if cotton is being twisted, the thread passes under a roller immersed in water (if silk or wool, this is omitted), then through a guide, from which it passes to the second bobbin or spindle, similarly formed to the other, but placed vertically, and revolving in a different direction, which gives the thread a second twist. This bobbin is moved up and down on its spindle by an eccentric on the main axle, for the purpose of winding the thread regularly and evenly. The rotation of the last bobbin is regulated by a small-grooved pulley placed beneath it; in the groove of this pulley, and partly enveloping it, is a cord with a weight attached to it, and by causing the cord to embrace more or less the circumference of the pulley, and thereby increasing or diminishing the friction, the tension of the thread as it is wound on the bobbin is determined. By this arrangement the thread is twisted with greater speed and perfect regularity, neither are the colours liable to be mixed, but remain perfectly distinct and visible after the twisting. *Patent completed.*

1720. C. W. Heckethorn. *Improved apparatus for obtaining and applying motive power.* Dated June 9, 1862.

Here the inventor proposes to attach to a shaft a series of hollow spokes, to the closed ends of each of which a bellows is fixed, the upper or moveable plate or cover of the bellows being weighted with metal. The bellows communicate with the hollow spokes by suitable openings at the places of attachment, and the hollow spokes communicate with each other by an opening through the shaft. The apparatus is to be placed in a reservoir of water, the shaft being set in bearings some distance below the surface of the water, when it will be found that the weights on the bellows will force down and close the covers of those in a vertical position, and will open or separate those bellows on the opposite spokes, which would then be in a contrary or inverted position, the effect of which would be that the closed bellows would expel the air through the spokes into the opposite bellows, thus causing the series of inflated bellows on one side of the shaft to rise in the water, while those on the opposite side, being shut, would sink. When the spokes of the ascending bellows have just passed their highest point, and are in the act of descending, their weights in turn being uppermost, press down the bellows, which sink in the water, aiding those on the opposite side to ascend. By these means a powerful rotary motion is communicated to the shaft, and by placing suitable gearing thereon, the power thus obtained may be applied to machinery or other purposes. *Patent abandoned.*

1721. F. Giachosa. *Improvements in ventilating mines, ship's holds, and other places.* Dated June 9, 1862.

The object here is to facilitate the removal of carbonic and other obnoxious and deleterious gases or vapours from mines and other places. For this purpose, the patentee uses chambers formed by covers and diaphragms or partitions, the surface of which are combined by cylinders of leather, or other suitable flexible material. The bottom of the chamber, or the lower of a series (when a series is employed), is connected by a cylinder of leather or other suitable flexible material, to a bell-mouthed collector, adapted to collect or admit of the flow of the gases from the lowest surface where such apparatus is applied. Motion is given by suitable mechanism to the diaphragms or partitions to the chambers, or to one of them, to effect the alternate expansion and contraction of the chamber or chambers for the reception of the gases, and for their being forced upwards by suitable passages, in connection with such chamber or chambers. *Patent completed.*

1722. A. J. Joyce. *Improvements in lighting and heating.* Dated June 9, 1862.

This invention consists in enclosing or encasing lamps, furnaces, and apparatus for effecting combustion, whether for the purposes of lighting or heating, in a chamber case or vessel containing and supplied with compressed air, and furnished with ingress and egress valves, for allowing of the introduction of fresh compressed air, and of the escape of such portions of the compressed air as may be necessary. The patentee places the ingress valves, by preference, at bottom, and the egress valves at top, but always under such conditions that the compressed air shall pass first through the fuel to feed its combustion, and afterwards through, round, or over the ores, crucibles, boilers, or other matters that have to be heated, finally escaping by transit through a water cistern, and he weighs them according to the pressure required to be maintained. *Patent completed.*

1723. A. Knowles. *Improvements in apparatus for washing extracted wool and other fibre.* Dated June 9, 1862.

For the purposes of this invention, the patentee employs a wooden vat, having a false bottom of perforated metal, and furnished with suitable pipes or passages, so that water may be caused to flow continuously through it. In order to agitate the contents of the vessel, and to keep them in motion, three, or other convenient number of axes are mounted horizontally over the top of the vessel, and transversedly to the length thereof. A series of bars descend from these axes and dip into the vessel, where they act as stirrers, the axes carrying them receiving a vibrating motion from a crank, or in any other convenient manner. The two axes near the ends of the vessel are connected with the crank, or other instrument, so as to move in unison, but the central axis has a reverse action communicated to it, the connection with the driving power being made above the axis, in place of below, as is the case with the other axes. This method of working the agitators causes their action to be very complete. The ends of the vessel are lined with plates, which curve inwards at the top and bottom; this form is given to them to assist the circulation of the liquid in the vessel, and prevent it being driven over at the ends by the action of the agitators. *Patent completed.*

1724. W. Smith. *Improvements in photography.* (A communication.) Dated June 10, 1862.

This invention relates to the ornamentation of photographic works, and chiefly to the production of back grounds, borderings, and such like aids to the art of photographing objects. For these purposes the inventor produces the design required by employing a sheet of glass, or other equivalent transparent substance, upon which, by galvanic agency, he deposits, first, a coat of gold or other metal suited for the purpose, and next a coat of platina or other equally suitable metallic surface. He then engraves, by means of a still or point, the required ornamental design, so that light may pass through the lines so marked, engraved, or cut into or through the metallic surface. An open space may be left in the centre or other part or parts of the plate prepared, as described, so that a portrait or portraits, or other subject or subjects, intended to be reproduced may be introduced behind or before such space, or otherwise in combination with such engraved plate. *Patent abandoned.*

1725. T. Lister. *Improvements in the material to be employed for address cards, visiting cards, labels, railway tickets, &c.* Dated June 10, 1862.

This invention consists in the application or employment of sycamore, beech, holly, or other suitable kind of wood, cut into thin slips or shavings, to any convenient size and form, as may be required for address cards, visiting cards, labels, railway tickets, and other similar purposes, whether for printing or writing upon, as a substitute for paper, card-board, or other material usually employed for such purposes. *Patent abandoned.*

1726. J. Kinlock and T. Edmeston. *Improvements in looms for weaving.* Dated June 10, 1862.

This invention relates to an improved mode of regulating the yarn beam, so as to give the necessary equal tension to the yarn as the beam varies in diameter, and consists in fixing a cam or eccentric on the crank shaft of the loom; the cam or eccentric acts upon an arm, or lever, connected by a rod to a sliding stud, which slides downwards on a quadrant lever as the yarn is taken off the beam in the process of weaving. The said quadrant lever is a portion of a clip or strap passing round a pulley, and is tightened so as to maintain the requisite friction by means of a screw passing through the ends of the clip, the pulley being secured on the end of a small shaft, carried by a fixing on the loom side, instead of the original fixing for carrying the yarn beams. The end of the shaft is hollow, into which the pivot of the yarn beam is placed, and is carried by it. At the end of the beam is fixed a flange, in the outer surface of which are cut two slots or holes, a similar plate or flange being fixed on the small shaft, with two studs extending into the slots or holes, thereby securing the yarn beam to the small shaft, and also enabling it to be easily taken out and replaced. The small shaft is caused to oscillate by means of the cam or eccentric fixed on the crank shaft through the aforesaid clip, the cam or eccentric being fixed so as to relieve the yarn when the stud is open, and close it when the stud is closing. The sliding stud is attached to a lever by a rod passing down at the end of the clip, which lever is carried by a fixing secured to the clip; the other end of the lever is pressing against the yarn beam by the preponderance of the rod and sliding stud, and, consequently, moves downward as the yarn beam diminishes in diameter, thereby increasing the stroke or oscillation of the beam as required. The lever being attached to the clip, there is no friction at the point where the lever presses on the beam, as all parts oscillate from the same centre. The yarn is also allowed to pass along through the clip by the pulley slipping round, and the clip is a more regular friction than the present plan of weights and ropes. *Patent completed.*

1727. J. A. Pols. *An improved method of refining oils.* Dated June 10, 1862.

In the case of rape, olive, or cotton seed oil, the patentee mixes with it American potash, quick lime, and white vinegar, to a strength of 36 degrees Beaunie. After subjecting the oil to this solution, it is filtered through charcoal, sawdust, and salt. By this process the patentee produces a good oil for burning. For machine oil he uses a solution of chloride of lime of the strength of 20 degrees, with 2½ to 3 degrees of sulphuric acid. By this process, after filtration, he produces a bright oil, free from grit, and not to be affected by cold. *Patent completed.*

1728. N. Davis. *An improved propeller for ships or vessels.* Dated June 10, 1862.

This invention consists of a horizontal propeller to be worked at the sides of ships, and is composed of a series of oars or paddles united by a frame. To retain its horizontal position this propeller requires double shafts, to which it is adjusted by cranks, and the whole is to be protected by a box of proportionate size. The horizontal propeller, the paddles of which can be increased in number according to the length of the ship and force of the engine, enters the water nearly perpendicularly, and emerges from it in the same way. In every revolution it is submerged, and then rises above the water. In the former position it gives the impetus to the vessel, and in the latter the vessel is left partly to exhaust the speed imparted to it, without meeting with the peculiar obstructions which are known to exist in the rotary paddle and in the screw now in use. *Patent abandoned.*

1729. G. T. Jourdain. *Improvements in treating cocoa-nut oil.* Dated June 10, 1862.

According to this invention, cocoa-nut oil is boiled in water, in which is cyanide of potassium, or of sodium, or of calcium and such boiling is continued till the oil is deprived of smell. The whole is then allowed to cool and settle; the oil is then separated from the matters which settle from it, and washed. *Patent completed.*

1730. H. C. Jennings. *Improvements in the preparation of skins for driving bands and harness traces.* Dated June 10, 1862.

The hides or skins are, according to this invention, to be deprived of hair by the usual means employed by tanners, or by solutions of caustic soda or potassa. The pelts or dehaired skins are now to be pared and rendered smooth upon the flesh side, so as to make every part of equal thickness, and are now to be steeped for two days in a solution of soda ashes, or of crystals of soda of commerce, or of pearl ashes, the solutions to be saturated with the above-named carbonated alkalies, at the ordinary atmospheric temperature, and they must remain in the solution until perfectly impregnated, and swelled to the maximum thickness; after this, the skins must be drained for a few hours, and then immersed in a saturated solution of sulphate of iron, with about 2 or 3 per cent. of sulphuric acid; when the iron liquid has penetrated completely into the skins, they are to be soaked in a solution of carbonated alkali, until the sulphuric acid of the iron solution is decomposed, and again to be returned to the solutions of iron, and so on, alternately changing the skins from the alkaline solution to the ferruginous solution, until the skins become firm and solid, and the whole of the gelatine is transformed into an insoluble substance. This object attained, the skins are to be wetted with the alkaline solution, and then steeped in a mixture of rosin oil, rock oil, paraffin oil, or naphtha, or any liquid hydrocarbonate, and in which has been dissolved 15 per cent. of gum, colophane, or resin, frequently turning and moving the skins to insure the penetration of the oily composition. When a perfect combination has been effected, which will depend upon the thickness of the skins or hides, the skins or hides are to be dried in the air, and when dry are to be rubbed or pressed with a mixture composed of equal parts of boiled linseed oil and turpentine. The skins are now to be cut into strips or bands, of the desired breadth, and are to be rolled or pressed to condense and equalize the substance. Before the bands are sewn or rivetted into lengths, it will be advantageous to rub into the surface a mixture of soft soap and cod or neatsfoot oil, to give the bands the proper degree of suppleness, without, however, producing too great elasticity by employing too much of the mixture. *Patent completed.*

1731. J. Alison. *Improvements in harrows.* Dated June 10, 1862.

In constructing harrows, according to this invention, a series of parallel axles are applied at each end of a suitable frame. Each of these axles carries rows of radial tines, which, at their lower ends, penetrate the surface of the land. These axles are alternately held from rotating, and are then permitted to rotate a distance so that another row of the teeth of each axle may come into action, whilst the row of tines of each axle, which has been in action for a time, comes out of action, and deposits any accumulation which has taken place on such tines. This periodical changing of the tines of the several axles may be accomplished in several ways, but it is preferred that inclines should be applied to the side of one of the wheels of the implement, which are caused to act, from time to time, as the wheel rotates on a lever, which is in connection with stops applied, in suitable positions, to retain the tines on the several axles from rotating till such stops are removed out of the way. These stops then again come into action, after allowing the rows of tines which have been in action to pass, in order to stop the next rows of tines and their axles from rotating till the points of those rows of tines have been for a time drawn through the surface of the land. It is preferred that the frame of this harrow should be so arranged as to admit of two rollers being interposed between the set of axles with their radial tines at one end of the machine, and the set at the other end of the frame, and also to admit of drilling apparatus being interposed between the two rollers. *Patent completed.*

1732. J. B. Ingle. *Improvements in reaping and mowing machines.* (A communication.) Dated June 10, 1862.

This invention relates to sweep rakes in harvesting machines which traverse on a vertical axis behind the cutter bar, and have crank arms, which turn in horizontal bearings, for the purpose of lifting the rake and holding it above the grain, while it is moving forwards towards the cutters. The first part of the invention consists in communicating motion to the rake mechanism from the main driving shaft, or other suitable shaft of the machine, by means of a yielding clutch, so arranged by a combination of inclined teeth on the moveable part of the clutch, with a pin or pins, or opposite inclined teeth, fast to the driving shaft, and a spring to keep the two parts of the clutch together, that the clutch only operates to move the mechanism of the rake when the harvesting machine is drawn forward, the rake ceasing to operate when the machine is backed. The second part of the invention consists in communicating the traversing motion of the rake to the vertical turn post or traversing axis of the rake, from a crank turning on a horizontal axis, and geared to the main driving wheel by means of two connecting rods jointed to each other by a compound or universal joint, one of the rods being connected to the wrist pin of the driving crank, and the other to the horizontal arm of the vertical turn post, the end of the latter rod extending through an eye guide in which it plays back and forth with sufficient freedom to admit of the gyration of the crank end substantially, as described. The third part of the invention consists in combining with a rake arm, supported by, and turning in, horizontal bearings in a horizontal traversing arm, vibrating on a vertical axis, a lifting arm, projecting from the rake arm, a stop placed on the back part of the frame of the machine, and a self-acting, holding, or rotating mechanism attached to, and traversing with, the rake arm, and independent of the main part of the machine, substantially as described, for the purpose of lifting the rake at the end of its back motion after it has discharged the grain from the platform, and sustaining the rake in an elevated position above the accumulating grain on the platform while moving forwards towards the cutters. And this part of the invention further consists in tripping the latch by suitable means at the end of the forward motion of the rake towards the cutters, for the purpose of permitting the rake to descend to the platform at the proper time to commence raking, substantially as described. The fourth part of the invention consists in driving a sweep rake from the cutter bar shaft of a harvesting machine, by means of a worm on the cutter bar shaft, a worm wheel carrying a crank and rotated on a vertical axis by the worm wheel on the cutter bar shaft, and a connecting rod from the horizontal traversing arm which carries the rake to the wrist pin on the crank carried by the worm wheel or their equivalents, substantially as described. *Patent completed.*

1733. J. G. Appold. *Improvements in regulating the discharge of water and other liquids and air and other gases.* Dated June 10, 1862.

This invention relates to a novel arrangement of automatic apparatus, whereby the rate of discharge of water, air, or other fluids, supplied at varying pressures, may be equalized or made nearly uniform. This result the patentee obtains by mounting in a suitably shaped chamber, through which the water or other fluid is passed, a swing valve, the movement of which (under the excess of pressure of the water), from its vertical position, will contract the discharge passage, and thereby limit the discharge of water. *Patent completed.*

1734. J. Shand and S. Mason. *Improvements in steam boilers.* Dated June 11, 1862.

This invention relates to improvements in the construction of boilers or steam generators (applicable to steam fire-engines), such as described in the specification of a patent granted to the present patentees, dated April 11, 1831 (No. 889), wherein an external and internal cone are employed, the latter forming the fire-box and chimney. The patentees have found in practice that the upper part of the internal cone which passes through the steam space is liable to be over-heated, and the object of the present improvements is so to modify the upper part of the internal cone or chimney that the over-heating may be avoided, the extreme heat being transmitted to the water as it is supplied to the boiler. For this purpose they prefer to contract the internal cone or fire-box below the water line of the boiler, and above the horizontal annular tube, through which the hind axle passes (when the boiler is intended for a portable steam or fire-engine), so that the upper or contracted part of the internal fire-box forms a parallel tube, or nearly so. The contracted part of the chimney of the fire-box is surrounded by a casing which forms an annular space ascending near to the top of the boiler; into this space the feed-water is forced, and when full it flows over into the boiler. *Patent completed.*

1735. W. Lennon. *An improved safety stirrup.* Dated June 11, 1862.

The documents relating to this invention cannot at present be seen, an extension of time for filing the final specification having been granted.

1736. J. D. Wake. *Improvements in the construction of ships and vessels.* Dated June 11, 1862.

This invention consists, 1, in constructing ships with double or single wooden floors, with iron ribs or frames of T iron, or double angle iron riveted back to back to form T iron, also with reverse angle iron where required for ceiling. 2, In uniting the iron ribs to the wooden floors by either inserting them underneath the bottom of the floor of the double angle or T iron rib, or by bringing the ribs alongside of the floor, one side being underneath the floor, and acting as a shoe at floor heads, bolting the rib or frame to the floors either up and down or sideways, as convenient, the ribs or frames extending underneath the floor, and meeting in the centre line, and joining the two ribs or frames by a plank riveted together. 3, In the employment of a longitudinal iron plate as a sheer streak outside the frames from stem to stern, and an iron plate along the floor heads outside to connect the diagonal bracing. By these means the patentee entirely dispenses with all vertical timbers between the skins of the vessels. *Patent completed.*

1737. H. Bland. *Improvements in sewing machines.* Dated June 11, 1862.

This invention consists, 1, in constructing sewing machines horizontal instead of vertical, that is to say, the work to be sewn is held vertical, whilst the needles pass horizontally through same, and is designed especially for sewing leather or other material edge to edge, without turn-down or seam. The patentee proposes to use two needles, one at each side of the machine, so disposed as to cross each other at an angle in passing through the work. Each needle-holder slides freely between guides, and turns on a pivot, so that, as each holder aforesaid comes into contact with a small roller, the needles will be pushed forward, and thus advance the work another stitch forward, and so on in succession. In connection with the foregoing parts the patentee proposes to employ a "looper," or hook, to extend the loop and insure its passing the point of the opposite needle. 2, In constructing sewing machines upon the principle lastly above described, but vertical instead of horizontal, and in adapting thereto a simple feeding apparatus worked by a cam on the main driving spindle of the machine. The aforesaid feeding mechanism works between collars on the main driving spindle, and the length of stitch may be adjusted by a pin passing through a slot in the feeder rod; both needles are worked by one cam. 3, In constructing sewing machines, as follows:—He employs two straight needles, each connected to a holder, also connected to bent or curved arms or levers jointed together, one extending above the bed-plate of the machine, and the other below the said bed-plate, so that each needle in passing through the work to be sewn describes an arc of a circle; but as the point of each needle inclines outwards, it follows, therefore, that after said joints have passed through the work, and in consequence of each needle being inclined, the effect is to cause the said needles to press or force the work forward or away from the points of the needles, and thus the needles become feeders of the work thereto. He proposes, in conjunction with the above, to employ a holder for keeping the work steady as the needles pass through same. An important feature in this arrangement consists in attaching the aforesaid curved arms of the uppermost needle-holder to the outside of the bed-plate of the machine, and in so curving or bending the same that their opposite ends meet together at the centre of the said bed-plate, where they are connected together and to the needle-holder, which may be adjusted to any desired angle by a thumb-screw. A screw may also be employed to adjust the lowermost needle-holder and needle. The several parts are operated upon by a cam. If desirable, an ordinary feeding-bar may be employed, and worked in conjunction with the needles for advancing the work. Lastly, these improvements relate to a new and improved mechanical arrangement or contrivance for regulating or adjusting with certainty the proper degree of tension upon the sewing material employed. *Patent completed.*

1738. W. Holland. *Improvements in carding engines.* Dated June 11, 1862.

In carding engines it has been heretofore customary to employ a large sheet metal or tin trough to guide the fleece from the doffer to the cylinder rollers or drawing box, and the trough, as it has been heretofore employed, is found to be expensive and inconvenient. Now this invention consists in dispensing with the trough above referred to, and in guiding the fleece from the doffers to the calendar rollers or draw box by means of a simply shaped, less expensive, and more effective instrument, consisting of a guide plate placed before the calendar roller or draw box. When a trumpet-mouth or funnel is used, the patentee attaches the guide thereto, but when trumpet-mouth or funnel is used the guide may be fixed by means of brackets or other fixings to the carding engine in any convenient manner. The object to be attained by the use of this guide or guide plate is to cause the selvages of the fleece to curl on leaving the doffer, and thereby prevent the jagged edges of the fleece from falling down, which has not hitherto been effectually done. To effect this object he makes the guide or guide plate of a rounded or segmental shape in the centre, with protuberances or horns at each side, forming recesses (as shown in the drawings), and thereby causing the selvages of the fleece to turn in or curl under before the fleece reaches the calendar roller or draw box. *Patent completed.*

1739. W. Crook. *Improvements in looms for weaving.* Dated June 11, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1740. D. Crickton, W. Doubavaud, and D. Crichton. *Improvements in looms for weaving.* Dated June 11, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

1741. J. Marsh. *Improvements in the manufacture of lace.* Dated June 11, 1862.

The object of one part of these improvements is to obtain various ornamental effects to lace, by causing holes or parts of the fabric to incline or otherwise diverge from, or to be at angles to, the selvage thereof by the use of additional warp threads forming part of the fabric, or which may be used as temporary lacing threads, such additional warp threads being caused to pass through from one side of the fabric to the opposite, and there change relative position with other of the threads if desired, and their return by another hole or mesh. *Patent abandoned.*

1742. J. H. Johnson. *Improvements in cradles or swing cots.* (A communication.) Dated June 11, 1862.

This invention relates to a mode of rendering cradles or swing cots self-oscillating, and consists in applying to one or both of the standards or supports a clock mechanism, consisting of a barrel spring, which imparts motion to a revolving eccentric pin through a pair of spur wheels. The eccentric pin works in a suitable opening or slot in an escapement lever, which transmits the oscillating motion to the body of the cradle or cot so soon as the spring is wound up. Provision is also made for disengaging the clock mechanism when desired, and a stop or pin is used for stopping the oscillations when the cradle is required to be at rest. *Patent abandoned.*

1743. B. W. Gerland. *Improvements in the manufacture of sulphate of copper.* Dated June 11, 1862.

This invention relates to a process for obtaining sulphate of copper in a comparatively pure state, and also other substances (cobalt, silver, nickel, and uranium) from solutions of copper ores, or other compounds of copper. In order to carry out this invention it is necessary to convert the copper of the material used with sulphate of copper, if it does not already exist in that state. It is, in most cases, convenient to extract the copper and other metals from the ores or other compounds while in their native state, or, after some preparation with muriatic acid, by which means solutions are obtained containing the chlorides of silver, copper, cobalt, nickel, and uranium, together with, more or less, impurities. *Patent completed.*

1744. J. E. Holmes. *Improvements in machinery for cultivating or harrowing land.* (A communication.) Dated June 11, 1862.

The prongs or teeth of this harrow are, by preference, curved at their points, and are arranged radially round central bosses, which are mounted loosely on horizontal shafts, that are set diagonally, or at an angle, to the line of draught. Any convenient number of these sets of radially-arranged teeth, tines, or prongs, may be mounted on the diagonal shafts, and, from their position, the very act of drawing them over the surface of the land will cause them to rotate on their axes, and, in so doing, the weight of the implement will cause the points of the teeth, tines, or prongs, to dig into the ground, and tear up the same, and with it any weeds with which the tines may come in contact. The diagonal shafts are set at opposite angles, and, at one end, are brought nearly close together, while the other ends diverge, and are held in position by a segmental bar. The implement is drawn forward by a loop, hook, or eye, placed near the apex of the angle formed by the meeting of the two diagonal shafts. In order to take any undue strain off the diagonal shafts, the draught hook, or eye, is attached to a central draught bar, which extends from the front to the segmental bar at the rear of the implement. Fixed broad shares, cutters, scarifiers, or other analogous tools, may be adapted, if desired, to any convenient part of the draught bar, or the segmental bar. *Patent abandoned.*

1745. J. Hetherington. *Improvements in lubricating revolving surfaces.* Dated June 11, 1862.

This invention refers to an arrangement in which the lubricating material is carried within a chamber formed in the revolving part, and consists in arrangements whereby the patentee is enabled to renew the supply without the removal of such revolving part. For this purpose he adapts thereto a tube which revolves with it, and projects inward towards the centre of motion, so that the surface of the lubricating material is kept below the orifice thereof. Or, according to another plan, he forms a communication with the chamber through the shaft, which communication is capable of being closed by a screw, plug, or equivalent apparatus. *Patent completed.*

1746. J. Ingham and W. P. Wood. *Improvements in preparing colouring matters for dyeing and printing.* Dated June 12, 1862.

This invention consists in mixing red analine dye with caustic soda, or any other alkali (except analine), and subjecting the same to heat until blue or violet colour is produced, as required. The mixture or compound is then dissolved in spirits of wine, or any other suitable solvent. *Patent completed.*

1747. T. Spright. *Improvements in horse hoes.* Dated June 12, 1862.

This invention relates to a previous patent, dated 22nd Sept., 1859 (No. 786), and consists in suspending the shaft or bar to which the hoes are attached upon a bearing at its centre, instead of at each end, so that, when one end is raised by turning a handle or otherwise, as described in the specification of the former patent, the other end is lowered in a corresponding degree, and thus, when working over ridged or curved surfaces, or along what are called "lands," the depth or bite of the hoes may be regulated by the attendant with the greatest nicety. *Patent abandoned.*

1748. F. Tolhausen. *A new or improved surgical injecting apparatus.* (A communication.) Dated June 12, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1749. A. A. Lerenard. *Improvements in cement or mastic for making joints of steam, water, or gas pipes or chambers.* Dated June 12, 1862.

The patentee claims, 1, employing india-rubber, more or less vulcanized, to make a cement or paste fit for making joints of steam, water, or gas pipes, by combining and mixing, by a suitable trituration, the vulcanized or non-vulcanized india-rubber, in various proportions, with powdered mineral or earthy substances, among others, and especially with a powdered hydraulic cement, fire-clay, and flowers of sulphur. 2, The formation of sheets of various thicknesses by mixing in the cement some hemp or other textile material cut in small pieces, and cutting rings, square bands, or strips from the said sheets for making joints. 3, Using the same cement in a softer or more liquid state, that is to say, containing less powdered hydraulic cement and sulphur, to make joints with strips of hemp doubled up or coated with this india-rubber solution. *Patent completed.*

1751. H. S. Firman and W. J. Williams. *Improvements in lamps more particularly designed for burning paraffin or coal oil and other hydro-carbons of different grades, or any combustible material used for obtaining light.* (A communication). Dated June 12, 1862.

This consists, essentially, of a lamp body of the usual or other form, in the top of which is firmly fixed a block, through which the wick tube passes so loosely that it may be slipped up or down, yet sufficiently tight to retain its position. The block is surrounded by a conical case, which is surmounted by a dome-shaped deflector, the case being perforated with holes at the bottom, and the base of the deflector being also perforated. Between the case and the block is interposed any substance that is a slow or non-conductor of heat, but, by preference, a block of wood, which is intended to prevent the wick tube from becoming too much heated, and thus conducting caloric down into the oil, thus increasing the evaporation. This arrangement also tends to diminish the danger of explosion should the oil in the lamp be of an explosive nature. The inventors secure the deflector or chimney, or both, to the cap or top of the lamp by a spring. *Patent abandoned.*

1752. A. Salviati. *An improved mode of producing indestructible inscriptions and ornamental surfaces in gold and other precious metals.* (A communication.) Dated June 12, 1862.

These ornamental surfaces are composed of a combination of glass, enamel, or vitreous materials, with thin sheets of gold and silver, or both. According to one modification, the patentee takes a thin sheet of metal, either gold or silver, and having heated in an oven the piece of glass to be ornamented, so that it may be softened, he places the thin sheet of metal thereon. Or the thin sheet of metal having been laid on a table, the piece of glass having been previously softened by being heated in an oven, is brought nearly into contact with the metal, which will immediately attach itself to the glass, and then upon applying a very thin sheet of glass to the metal surface, the latter will be protected by a vitreous coating. *Patent completed.*

1753. B. George. *Improvements in the construction of portable beds, bolsters, pillows, and sofa and other cushions.* Dated June 12, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1754. W. Jackson. *An improved shield for the gums, to protect them from injury when cleaning the teeth.* Dated June 12, 1862.

This consists in the use of a thin metallic plate, which is made to fix over the gums close up to the necks of the teeth, leaving the whole enamelled surface of the teeth exposed. A separate plate is fixed to the upper and lower jaws, and the plates are kept in place when in use by spring attachment or otherwise. *Patent completed.*

1755. W. Smith. *Improvements in apparatus for cutting or dividing soap.* Dated June 13, 1862.

This consists in the combination of a stationary grooved stage or rest for the soap intended to be cut or divided, with a moveable frame working on moveable or fixed centres, and containing a set of adjustable knives or cutters. The stage or rest is fixed on a horizontal table, by preference in an inclined position, and the grooves are formed therein at suitable distances apart. The moveable frame, which carries the cutters or dividers, has its centres of motion also fixed (or by preference moveable), to the horizontal table, and is worked by a handle at the end opposite to such centres of rotation. The cutters or dividers consist of wires tightly stretched and fixed in the frame or blades, corresponding in number and relative distances apart with the grooves in the stage or rest. The adjustment of the cutters or dividers is effected by slots in the frame and tightening screws, or by other means. *Patent abandoned.*

1756. G. Haseltine. *Improvements in the construction and application of rails for railways.* (A communication.) Dated June 13, 1862.

The nature of this invention consists in dividing the metal used in making the ordinary single bar flange rail into two parts, which may be termed the "wearing rail" and the "supporting rail," and combining them together in distinct horizontal planes, or parallel with each other, by means of intermediary plates or blocks, in combination with clamping hooks, or their equivalents, arranged and secured at equal distances apart from each other, and also in such uniform relation to the previously determined distances apart of the cross ties or ground sills used for the foundation of the said combined rails, so as to bring the points of attachment, or application to the cross ties or ground sills, at such parts only of the supporting rail as will be mid-way between each pair respectively of the said combined plates and clamps. The invention further consists in securing each of the joints which occur at the abutting or contiguous ends of the said "weaving rails," by a longer intermediary plate, in combination with clamping hooks, or their equivalents, the said plate being arranged along between the supporting rail and the abutting or contiguous ends of the "wearing rails," so as to be together with the said joint midway between two adjunct cross-ties or ground sills, for the purpose of giving to this part of the track the same general elasticity, and at least the same equality of strength, which are characteristics of the other portions of the same. *Patent abandoned.*

1757. A. Longbottom. *Improvements in the manufacture of artificial stone.* Dated June 13, 1862.

This artificial stone is intended for cleaning and scouring, and other household purposes. It is composed as follows:— For every hundred parts of the compound, the patentee takes sixty parts by weight of the ordinary dehydrated sulphate of lime or gypsum; to this he adds twenty parts of oxide of calcium or caustic lime, ten parts of steatite, and ten parts of zeolite; or, by preference, eight parts of silica and two parts of hydrate of sodium. These substances are to be intimately blended by trituration, in any convenient apparatus. Water is now added in a sufficient quantity to form it into a plastic or semi-fluid mass, suitable for moulding it into any desired shape. The moulded compound when dry is white, but a colouring matter may be added. *Patent completed.*

1758. J. Wilson. *Improvements in the construction of ships for war purposes, applicable also to the mercantile marine.* Dated June 13, 1862.

Here the patentee arranges wood and iron or steel in alternate layers, either horizontally, diagonally, vertically, or otherwise, so that the force of the blow of a projectile shall not impinge against the side of a metal plate, but against the edge thereof. He proposes also, at a certain distance below the water line, according to the power of the projectiles to which any vessel might be exposed, to place and bolt firmly together alternately plates of wood and iron or steel, either horizontally to the keel of the ship, or perpendicularly to it, as may be found most advantageous. In either case it is not the side of the plate which could be subjected to the blow of a projectile, but the edge, and this constitutes the essential feature of this invention. He also proposes to place over all an external plating of iron and steel, so as to distribute the force of the blow over several of the iron or steel plates. *Patent abandoned.*

1759. J. H. Glew. *Improvements in sewing machines.* Dated June 13, 1862.

This relates to sewing machines in which two needles and two shuttles are employed, and consists in an improved arrangement of placing the shuttles, and employing a web or vertical plate in the middle of the shuttle race. The patentee places the shuttles face to face on each side of the web, by which means two rows of stitching can be obtained much closer than by any other method, the web being employed to form part of the guide or race for each shuttle. *Patent completed.*

1760. C. A. Tyler. *A new or improved holder for holding dinner and other plates and dishes, and for other like purposes.* Dated June 13, 1862.

This consists of two or more plates or blades connected or joined together by a spring-bow, or jointed after the manner of a pair of scissors, one of the blades being larger than the other. The under blade fits the under side of the edge of the plate or dish, and the upper blade the upper side thereof. *Patent completed.*

1761. T. W. Fleming. *Improvements in preparing charges for firearms.* Dated June 13, 1862.

Here, when preparing charges for fowling pieces, the inventor encloses the slot in a cylindrical case of paper or other thin and easily broken material; this case he makes of a diameter to correspond with the bore of the gun. To the rear end of this case he attaches the propelling charge, consisting of a cylinder of compressed gunpowder, with a hole in one end of it, and he provides the rear end of the shot case with a projecting peg, which he makes, by preference, by screwing up the paper of which the shot case is made. This peg he introduces into the hole in the compressed cylinder of gunpowder, which thus becomes attached. In order to protect the compressed cylinder of powder from injury, from being carried in the pocket or otherwise, he uses a cap of pasteboard, which fits over the cylinder of powder, and on to the projectiles. In making ball cartridge he papers the projectile in the usual way, and screws up the paper so as to make a peg at the rear of the projectile, and this peg he makes to enter a hole in a charge of compressed gunpowder, as in the case of the sporting cartridge; and thus he attaches the propelling charge to the projectile, *Patent abandoned.*

1762. J. Bormingham. *Improvements in the construction of vessels of war, which improvements are also applicable to the construction of vessels for commercial and other purposes.* Dated June 13, 1862.

The principal novel features here consist in constructing such vessels of a flattened oval form in section, with the timbers running in a longitudinal direction from end to end, like the staves of a cask, the timbers being bound together by wrought-iron hoops, shrunk or driven in. The interior of the vessel is supported at intervals by transverse vertical divisions or bulk heads, which may also serve to divide the vessel into water-tight compartments. The timbers of the vessel all run off to a fine point at the bow, which is terminated by a solid iron beak or prow. For vessels for warlike purposes, the hoops enclosing the timbers touch each other, and form an armour or plating from end to end of the vessel. If a vessel all constructed of iron be preferred, longitudinal iron plates may be substituted. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Nov. 6, 1862.

3003. F. Goodyear, Old Change, St. Paul's. A machine for plaiting straw and such like material. (A communication.)

Dated Nov. 20, 1862.

3123. J. W. Hjerpe, W. Holmgren, and A. V. Sunstedt, Stockholm, merchants. An improved composition or preparation of materials applicable for igniting matches.

Dated Dec. 6, 1862.

3279. R. E. Donovan, Court Duffe, Dublin, gentleman. Improvements in the means and apparatus for the prevention of railway accidents.

Dated Dec. 11, 1862.

3318. I. Spight, Glandford Briggs, Lincoln, iron founder and agricultural machine maker. Improvements in horse hoes.

Dated Dec. 12, 1862.

3330. J. Gaskell, Blackburn, and H. Walmsley, Great Harwood, near Blackburn. Improvements in regulating the tension of yarn in the processes of warping, winding, sizing, weaving, and other similar purposes.

3332. A. Mills, Seaham Harbour, Durham, boot and shoe maker. Improvements in reefing and unreefing, furling and unfurling sails of ships and other vessels, and an improvement in the rotary yards and the journals in which the sockets or ends of the rotary yards work.

Dated Dec. 15, 1862.

3345. M. J. Roberts, Pendarren House, near Crickhowell, esquire. Improvements in means and apparatus for preparing and spinning wool, cotton, and other fibrous substances.

Dated Dec. 18, 1862.

3385. E. Habel and E. Suckow, Manchester, machinists. Certain improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous substances.

3389. J. Pernod, Avignon, France. A production derived from madders, called "purpurine."

3390. J. Savory, Bond-street. A new or improved apparatus for the inhalation of medicinal powders or vapours for the treatment of diseases of the throat and lungs. (A communication.)

3391. J. Longland, Landport, Hants. Improvements in street lamps.

3393. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improved apparatus for transmitting power. (A communication.)

3395. I. Holden, Bradford, York, machine wool comber. Improvements in means or apparatus for washing wool and other fibres.

Dated Dec. 19, 1862.

3397. W. S. Longridge, Alderwasley Iron Works, Ambergate, Derby, engineer. Improvements in machinery for rolling tyres, hoops, and rings.

3398. E. B. Wilson, 5, Parliament-street, Westminster, civil engineer. Improvements in machinery or apparatus for forging and pressing metals and other substances.

3400. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improved machinery for attaching metal eyelets to cloth and other materials. (A communication.)

Dated Dec. 20, 1862.

3402. J. B. Morrison, East Springfield, United States. Improvements in washing machines. (A communication.)

3404. A. T. Blakeley, 24, Montpelier-square. Improvements in breech-loading ordnance.

3405. J. Nettleton, 34, Sloane-square, Chelsea. Improvements in stoves.

3407. J. Cowpe, Mill End, near Newchurch, Lancaster, waste breaker. Improvements in machinery for tearing, breaking up, and reducing rags, ropes, waste fabrics, and other similar fibrous materials.

3408. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improvements in the manufacture of automatic toy figures. (A communication.)

3409. J. Platt, Oldham, and W. Richardson, mechanical engineers. Improvements in scutchers or beaters of cotton, machinery also applicable to other machinery in which shafts are caused to revolve at high velocities.

Dated Dec. 22, 1862.

3412. J. McLean, Broxburn, Linlithgow, manufacturing chemist. Improved apparatus or arrangements for obtaining oil and other products from shale and the like bituminous minerals.

3413. W. Francis, Burslem, grocer. Improved apparatus for cutting soap.

3416. E. R. Dann, Nottingham, manufacturer. Improvements in goffering apparatus.

3417. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in stoves or apparatus for heating and drying. (A communication.)

3419. J. B. Dalhoff, Copenhagen, goldsmith. Improvements in cutting files, and in machinery to be employed for that purpose.

3420. C. Farrar, John-street, Horselydown, chemist. Improvements in machinery or apparatus to be employed in treating certain fibrous materials.

Dated Dec. 23, 1862.

3423. R. A. Brooman, 166, Fleet-street, patent agent. A new or improved colouring matter or dye. (A communication.)

3425. J. Patterson, Beverley, engineer. Improvements in machinery or apparatus for grinding, crushing, cutting, cleaning, and hulling or shelling various kinds of farm or vegetable produce, also applicable to the crushing or grinding of minerals and other substances.

3426. E. B. Wilson, Parliament-street, Westminster, engineer. Improvements in apparatus to be employed in the manufacture of malleable iron and steel.

3427. G. Haseltine, 12, Southampton-buildings, Chancery-lane. Improvements in the mode of, and apparatus for, converting petroleum or coal oil into gas for lighting and heating, the said improvements being especially applicable to lamps and stoves. (A communication.)

3429. S. Russell, 27, Shaftesbury-crescent, Pimlico. Improvements in stereoscopes.

Dated Dec. 24, 1862.

3430. T. C. Hinde, Cardiff, iron master. Improvements in furnaces or apparatus for generating carbonic oxide.

3432. G. H. Birkbeck, 34, Southampton-buildings, Chancery-lane, engineer. Improvements in instruments for surveying and levelling. (A communication.)

3434. F. N. Gisborne, 3, Adelaide-place, London-bredge, engineer and electrician. Improvements in the means for indicating the speed of ships at sea.

3440. H. Twelvetrees, Bromley, manufacturer. Improvements in washing machines.

3442. R. Lakin, Ardwick, Manchester, machinist, and J. Wain, Manchester, mechanic. Improvements in machines for spinning and for doubling cotton, and other fibrous materials.

3444. J. Taylor, Castle Iron Works, Stalybridge. Improvements in engines for carding cotton and other fibrous materials.

3446. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in apparatus for stamping or marking paper and other materials. (A communication.)

3450. C. J. Denton, New Broad-street, City, merchant. An improvement in the process of revivifying animal charcoal.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2362. H. P. Hughes. Sawing machines.

2364. J. and B. Harrison. Clod-crushers.

2381. J. G. Nutting. Manufacture of buttons.

2384. J. J. Potter. Upright pianofortes.

2389. J. J. Moeckel. Spinning fibrous materials.

2396. F. H. Lefranc. Manufacture of casks.

2397. W. Smith. Construction of furnaces. (A communication.)

2400. G. W. Dyson. Finishing and polishing circular metal rods, bars, and shafts.

2405. E. A. Pontifex. Steam traps or apparatus for facilitating the escape of condensed steam.

2406. E. T. Hughes. Manufacture of woven fabrics. (A communication.)

2407. E. C. Harding and C. Doody. Braces.

2408. F. Le Conte. Furnaces.

2410. J. H. Johnson. Coating or covering metallic surfaces with copper. (A communication.)

2411. J. Meyer. Production of jacquard cards.

2414. J. Walker. Treatment of kelp.

2416. J. Ellis. Corsets.

2417. A. J. Whitehead. Machinery or apparatus for preparing, spinning, and doubling fibrous materials.

2419. J. Watt and T. S. Haviside. Treating flax.

2433. A. Johnston. Pressing cotton.

2436. F. C. Bakewell. Fire places and stoves. (A communication).

2441. R. A. Brooman. Tools for boring. (A communication).

2449. R. P. Coles. Permanent way.

2507. J. and F. Walker. Combing, carding, or hackling fibrous substances.

2509. T. Molineux. Pianoforte actions.

2530. W. G. Rawbone. Gun barrels, and producing insciptions, ornaments, and devices, upon gun barrels, locks, plates, and other metallic parts of small arms.

2910. A. Krupp. Breech-loading ordnance and firearms.

3100. N. Thompson. Stopping bottles, jars, and other vessels.

3206. J. C. Robertson and W. C. White. Tap or cock.

3279. R. E. Donovan. Railway accidents.

3311. M. Osborne. Manufacture or cast-iron fenders.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Jan. 6th., 1863.

1735. W. Lennan.
1957. T. Edwards.
1961. J. H. Johnson.
1962. C. B. Gruner.
1969. H. Wethered.
1974. H. S. Pontifex.
1975. J. Rhodes.
1977. H. Eschwege.
1980. T. Green and R. Mathers.
1984. E. Jaudeau.
1986. J. Mander.
1991. J. Leeming.
1994. J. H. Johnson.
1997. J. Waithman.
1999. J. Orr.
2000. J. Miller.
2001. W. Bliss.
2012. D. Bateman.
2013. H. Barber.
2014. The Honourable W. E. Cochrane.
2016. G. Lowry.
2027. R. Ridley and J. G. Jones.
2035. T. G. Ghislin.
2054. J. R. Abbott.
2065. W. E. Newton.
2079. P. F. Cassegrain.
2091. A. C. Vautier.
2108. W. Clark.
2155. M. Henry.
2156. G. Nock.
2175. A. V. Newton.
2216. W. Clark.
2325. T. H Falkiner.
2404. W. Upfill, W. Morton, and W. Asbury.
2569. J. Bouvet.
2951. J. G. Marshall.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2993. W. E. Newton.
2997. H. Munster.
26. P. J. Worsley.
3000. J. Eason.
121. J. Burrows.
14. D. and S. Bateman.
25. J. Walls.
44. L. F. Perrier.
67. W. T. B. Allday.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

9. W. Bullough.
71. J. Ashworth, jun.
36. E. H. Bentall.
27. J. Fowler, jun.
44. H. Bessemer.
356. H. Bessemer.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design.
1862.			
Oct. 30,	4519	S. Greenberg, Birmingham	Scarf Rings.
,, 31,	4520	W. H. Blanch, Liverpool	Rifle Sight.
Nov. 4,	4521	W. Spurrier, Birmingham	Egg Cups.
,, 6,	4522	A. James, Redditch......	Needle Case.
,, 11,	4523	C. P. Lempriere, Birmingham	Fastener for Boas, &c.
,, 14,	4524	W. N. Wilson, High-Holborn	Needle Plate.
,, 18,	4525	Plumberg and Co., Cannon-street	A Plate Holder.
,, ,,	4526	W. Reavey, Sheffield ...	Sole Cutter.
,, 27,	4527	Hodge & Reed, Hatton-garden	Lantern.
Dec. 1,	4528	Smith and Wellstood, Glasgow	Cooking Table.
,, 4,	4529	W. Burroughs and F. Watts, Soho-square...	A Billiard Table.
,, 18,	4530	W. Thornhill, New Bond-street	Anti-Garrotting Cravat.
,, 30,	4531	S. Blake & Co., Sheffield	Printing Types.
,, 31,	4532	J. Harrison, Birmingham	Travelling Bag.
1863.			
Jan. 2,	4533	C. E. Penny, Cannon-st.	Envelope.

PROVISIONAL REGISTRATIONS.

1862.			
Nov. 4,	1387	W. B. Lord, Sandgate...	Cartridge Case.
,, 5,	1388	A. Bedborough, Wandsworth	Shirt Collar.
,, 11,	1390	S. Proctor, Elsecar, Yorkshire	Casing for Fire-places.
,, 13,	1391	Wright and Arkless, Ridgeway	Measure.
,, 22,	1392	W. Parkinson, Ripon ...	Brush.
,, 24,	1393	G. Kings and J. Gilbert Evesham..................	Oscillating Engine.
,, 29,	1394	J. Harper, Powick, Worcester	Cravat.
Dec. 1,	1395	J. E. Walton, Holloway	Smoking Pipe.
,, 2,	1396	F. S. Breach, Gosport ...	Pedestrian.
,, 10,	1397	G. Berry, Belgrave-sq.	Anti-Garrotter.
,, 12,	1398	R. Davies, Turnham-green	Plough.
,, 13,	1399	E. Edwards, Birmingham	Stay Hook.
,, 16,	1400	C. G. Lenk, Great Marlborough-street	Pen.
,, 22,	1401	S. Ash, Harwood-street	Wach Protector.
,, ,,	1402	J. Medwin, Regent-st...	Anti-Garrotter.
,, 24,	1403	H. Stokes, Coventry-st.	Boot.
,, 29,	1404	J. W. Lane and T. Coxhead.......................	Stud.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending January 9, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1573	1 2	1582	0 4	1590	0 4	1598	0 10	1606	0 10	1615	0 4
1574	1 4	1583	0 4	1591	0 8	1599	0 4	1607	0 4	1616	0 8
1575	0 4	1584	0 4	1592	0 8	1600	0 8	1608	0 4	1617	1 0
1576	0 4	1585	0 10	1593	0 4	1601	0 4	1609	0 6	1618	0 8
1577	0 4	1586	0 4	1594	0 10	1602	1 2	1610	0 8	1619	0 8
1578	0 4	1587	0 8	1595	0 10	1603	0 10	1612	0 8	1620	0 4
1579	0 4	1588	0 4	1596	0 8	1304	1 4	1613	0 4	1621	0 8
1580	0 4	1589	0 4	1597	0 4	1605	0 10	1614	0 8	1622	0 4
1581	0 4										

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Timber—Per Load.

	£	s.	d.
Teak	15	10	0
Quebec, oak, white	5	5	0
,, Birch	4	0	0
,, Memel...	6	0	0
,, Elm	3	10	0
,, Fir	3	10	0
,, Red pine	3	10	0
Dantzic oak	4	15	0
,, Yellow pine	3	15	0
St. John, N.B., yellow	5	10	0
Memel fir...	4	0	0
Riga	3	10	0
Swedish	2	15	0
Deals, per C., 12 ft. by 3 by 9 in.			
Quebec, white spruce...	16	0	0
St. John, white spruce	16	10	0
Yellow pine, per reduced C.			
Canada, 1st quality	18	0	0
,, 2nd do.	12	0	0
Archangel, yellow	15	0	0
St. Petersburg, yellow	13	0	0
Finland	10	0	0
Memel	13	0	0
Gothenburg, yellow	11	10	0
,, white	10	0	0
Gefle, yellow	11	10	0
Soderhamn	11	10	0
Christiana, per C. 12 ft. by 3 by 9 in. yel.	23	10	0

OILS, PAINTS, AND DRYSALTERIES.

	£	s.	d.
Lead, red	21	10	0
,, white	27	0	0
Oil, Seal, pale, per 252 gallons	48	0	0
,, yellow	45	0	0
,, Sperm	83	0	0
,, Cod	41	10	0
,, South Sea	38	10	0
,, Olive, Gallipoli, per tun	61	0	0
,, Palm, per tun	42	0	0
,, Cocoa-nut	52	10	0
,, Rape, pale foreign	52	0	0
,, Linseed, per cwt...	1	19	3
Rough, Turpentine, per cwt.	1	2	0
English spirit, without casks	4	0	0
Hemp Manilla	36	0	0
Jute	22	15	0
Hemp Rope	35	10	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
Iron:									
Welsh Bars, in London	per ton	6	15	0	to	7	0	0	2½
Nail Rods	,,	7	10	0	,,	7	15	0	,,
Hoops	,,	8	10	0	,,	9	0	0	,,
Sheets, single	,,	9	5	0	,,	9	10	0	,,
Staffordshire Bars ...	,,	7	15	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	6	0	0	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	14	0	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
Steel:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	10	0	,,	18	0	0	,,
Copper:									
Sheet and Sheathing, and Bolts	,,	105	0	0	,,	0	0	0	3
Hammered Bottoms...	,,	115	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	110	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	98	0	0	,,	0	0	0	,,
Tile Copper...............	,,	98	0	0	,,	0	0	0	,,
Best Selected...........	,,	101	0	0	,,	0	0	0	,,
Composition Sheathing Nails...............	per lb.	0	0	11	,,	0	0	0	,,
Yellow Metal Sheathing and Rods.........	,,	0	0	9½	,,	0	0	0	7½
Fine Foreign	per ton	98	10	0	,,	100	0	0	3
Tin:									
English Block	pr cwt.	115	0	0	,,	0	0	0	2½
Bar	,,	116	0	0	,,	0	0	0	,,
Refined	,,	120	0	0	,,	0	0	0	,,
Banca.....................	,,	119	0	0	,,	120	0	0	nett
Straits.....................	,,	117	0	0	,,	118	0	0	,,
Tin plates:									
Best Charcoal, I.C....	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
Lead:									
Pig, English	per ton	21	10	0	,,	22	0	0	2½
Spanish, Soft...	,,	20	10	0	,,	20	10	0	,,
Shot, Patent	,,	23	10	0	,,	0	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	27	10	0	,,
Spelter:									
On the spot	,,	18	0	0	,,	18	5	0	nett
Zinc:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
Quicksilver	pr btl.	7	0	0	,,	0	0	0	3
Regulus of Antimony:									
French Star...........	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 16, 1863.

ON AN INTERNATIONAL ASSIMILATION OF PATENT LAW.

A TRUE and new idea, whether embodied in a mechanical or chemical combination, whether developed in a product of art, or expressed in a literary work, is an international benefit. Such benefits are not limited to clime or race, but embrace all humanity, while supporting it in its moral, intellectual, and physical war for the necessities and luxuries of human life. The enunciator of a true and new idea being thus an international benefactor, how is it that such benefactors have never been rewarded by the comity of nations?

When either the patent for an invention, or the copyright of a book, or of a work of art is expired, the invention, in whatever form it may be, becomes international commercial property. Then, how is it that, with few exceptions, as in some cases of copyright and trade marks, a new idea does not receive international protection? In an article on Patent Law Reform, in our number for January 2nd, we placed in juxta-position certain clauses of the patent laws of the different countries—those clauses, namely, that bear upon the *novelty* of an invention. We believe that we were able to show, to some extent, how these different patent laws reciprocally hang together. We hope, in fact, that we made it plain to our readers that a patent, invalidated from want of novelty in any given country, was just as invalid in almost all the others. There being already more than 200,000 patents in existence, and also innumerable records and descriptions in home and foreign libraries, it may even be said that it is a mere question of time to upset eighty patents in any given hundred. If *absolute* novelty be required, scarcely any patent is tenable in any country. All these laws are at present built on a foundation of sand. We will now examine what international encouragement is given to invention as applied to manufacture, and will place in juxta-position the clauses of the different patent laws referring to imported inventions. We shall see how much these laws differ from each other. The position of the proprietor of an invention is the same in all countries. These laws cannot all be right, and some, therefore, must be unjust, both directly to the inventor, and indirectly to the country that might be enriched by the importation of an invention.

The present English law (14 & 15 Victoria, c. 83, clause 25), is as follows:—"Where, upon any application made after the passing of this act, letters patent are granted in the United Kingdom, for or in respect of any invention first invented in any foreign country, or by the subject of any foreign power or State, and a patent or like privilege for the monopoly or exclusive use or exercise of such invention, in any foreign country, is there obtained, before the grant of such letters patent in the United Kingdom, all rights and privileges under such letters patent shall (notwithstanding any term in such letters patent limited) cease and be void immediately upon the expiration or other determination of the term during which the patent or like privilege obtained in such foreign country shall continue in force, or where more than one such patent or like privilege is obtained abroad, immediately upon the expiration or determination of the term which shall first expire, or be determined of such several patents or like privileges: Provided always that no letters patent for, or in respect of, any invention for which any such patent or like privelege as aforesaid shall have been obtained in any foreign country, and which shall be granted in the said United Kingdom, after the expiration of the term for which such patent or privilege was granted or was in force, shall be of any validity." The English law does not fix any obligatory time for the working of a patent.

According to the present American law of May 4, 1861, in which are embodied the old laws of 1836, 1837, and 1839, "Even although the applicant has in good faith actually made an invention, a patent therefor will not be granted him if the whole, or any part of what he claims as new, had before been patented, *or described in any printed publication in this or any foreign country*, or even if it had before been invented or discovered in this country (Act of 1836, section 7), or if he has once abandoned his invention to the public; or if, with his consent and allowance, it has been for more than two years in public use on sale." (Act of 1836, section 6; Act of 1839, section 7.)

6. "The mere fact of prior invention or discovery abroad will not prevent the issue of the patent, *unless the invention has been there patented, or described in some printed publication.*" (Act of 1836, section 7; also Act of 1836, section 15.)

61. "If an alien neglects to put his invention in public sale within eighteen months after the patent is granted, and to continue it on sale to the public on reasonable terms, his patent will cease to protect him." (Act of 1836, section 15.)

59. "The taking out of a patent in a foreign country does *not* prejudice a patent previously obtained here; nor does it prevent obtaining a patent here subsequently.

"When the patent is granted here after being obtained abroad, it will extend only *seventeen* years from the date of the foreign patent."

According to the law of July 8, 1844, at present in force in France and Algeria, art. 29, "L'auteur d'une invention ou découverte déjà brevetée à l'étranger pourra obtenir un brevet en France; mais la durée de ce brevet ne pourra excéder celle des brevets antérieurement pris à l'étranger." This is similar to the British law. But according to art. 32, paragraph 2, "Le breveté qui n'aura pas mis en exploitation sa découverte ou invention en France, dans le delai de deux ans, à dater du jour de la signature du brevet, ou qui aura cessé de l'exploiter pendant deux années consécutives; à moins que dans l'un où l'autre cas, il ne justifie des causes de son inaction sera déchu de tous ses droits."

Whenever any great International Exhibition takes place, the question of protection to intellectual property is thrust forcibly forward from the very nature of things. Thus the present English law resulted partly from the Great Exhibition of 1851; and the proposed reform of the Patent Laws is in some measure consequent on the International Exhibition of 1862.

There is no patent law at present in Turkey, but we should not be surprised if a law should issue from the approaching International Exhibition in Constantinople. International Exhibitions are becoming international institutions, and an international convention as to patent rights is getting to be a universally felt necessity. The protection found necessary to offer to exhibited inventions, during the time of an International Exhibition, is of itself a rough international law. While upon the subject of a Turkish patent law, we will repeat a suggestive extract alluded to before the Patent Law Commission of 1852:—"In Thornton's 'History of Turkey,' he gives an account of a Turk who had invented a mode of making cast-iron which should be malleable, like wrought-iron. The secret died with the man, and, after his death, Englishmen spent some money and time in trying to buy his utensils, and taking such steps as occurred to them, to find out the secret, but they did not, which shows that some inventions are lost." This secret, as is well known, has been recovered. After the Great Exhibition in Paris, of 1855, the patent laws were also much discussed, and the result was a "Projet de loi sur les brevets d'invention," resulting from the deliberations of the "Conseil d'Etat" on the amendments proposed by the commission of the "Corps Legislatif," charged with the examination of the laws, 28th April, and 5th, 10th, and 11th May, 1859. As regards foreigners, this proposed law seems to be similar to the present one. We publish, in this number, a letter from a correspondent abroad, giving an account of the Austrian and Prussian patent laws.

The Austrian law of the 16th August, 1852, is framed in a just and equitable spirit towards foreigners. In paragraph 29 *b b*, an imported patent taken out in Austria is invalidated if it is proved that the patentee be not the original inventor or proprietor (cessionnair). According to paragraph 9 *c*, a patent imported from abroad into Austria expires with the mother patent. According to paragraph 29, 2 *a*, a patented invention must be put to work within a year from the date of the grant, and it also expires if it should remain for two years out of use. The Prussian law is simply a mockery for both Prussians and foreigners. A foreigner cannot legally obtain a patent at all. And yet many Prussian subjects—as, for instance, Mr. Krupp—possess very remunerative English patents. Prussia affords a very good lesson to opponents of patent rights. Having been for years substantially without a law, she is now introducing one. In England and in France, in which countries patent rights have existed for centuries, factious minorities are talking of their being abolished. As we said before, a patent law is now being discussed in Prussia, and it is probable that both France and Prussia are, to some extent, waiting for England to take the initiative in patent law reform.

Patent right is also just now the subject of some discussion in Belgium. The present Belgian patent law of 1854 is similar to the French law. A patent imported from abroad, expires when the original patent comes to an end. A patent must be worked (*exploité*) in Belgium within one year from the time it is put to use abroad. If it has ceased to be worked in Belgium for a year, it is to be considered as expired. The Dutch law is similar to the Belgian law, but two years are allowed to put the invention to work. There is a curious clause in art. 8 of the law of 1817. According to this clause, a Dutch patent is forfeited if the possessor should acquire an exclusive right to the same invention in any foreign country! According to articles 122 and 133 of the Russian laws of 1833 and 1840, if a would-be patentee be the veritable inventor and proprietor of the foreign patent, the duration of his Russian patent can be for 10 years, but in every case the term of the Russian patent must not exceed that of the original foreign patent. The patentee is allowed one quarter of the term of the patent, to put the same into operation (art. 142). According to the Swedish patent law of

1856, a patent, imported from abroad, cannot last longer than the original foreign patent. The patent must also be put to work within two years, a time which may be limited to one year by the Swedish examining commission, as also extended to four, if judged proper by the same commission. The Spanish law of the 27th March, 1826 (art. 3), says:—"Letters patent, for inventions imported from abroad (Patents of Importation), are only granted for five years, and available only for the working of the invention within the kingdom." Art. 21.—3, "If patentees have not put their inventions into practice themselves, or by others, within one year and one day; 4, If patentees give up their inventions by interrupting their works during one year and one day; 5, If the invention is published in a book, or by prints, models, plans, or descriptions, existing at the Royal Conservatory of Arts, or if it is worked in another country whilst it is represented by the patentee as new and original, the patent is invalidated."

The patent law of 1855 for the Italian kingdom does not give any right to the original foreign inventor before anybody who may choose to import and patent the invention in Italy. A patent from abroad lasts only as long as the original patent. A patent for five years must be worked within the year, and a patent for a longer period must be put to work within two years. According to art. 14, of the Portuguese law of 1837, a patent from abroad can only last five years in that country. It must be put into operation before the expiration of one-half of the term for which the patent has been granted.

Our article for Jan. 2nd must again be borne in mind. We showed therein that *absolute* novelty was everywhere required. We will, however, suppose that a man is in possession of that "rara avis in terris," an absolutely new invention, and that he wishes to secure the patent right in several civilized countries. To do this, a vast machinery must be set to work, and a proportionate amount of capital must be expended. We will again suppose that he is also provided with these requisites, and that he is an English patentee, with a patent just completed. This patent being completed, he finds that it is described in the MECHANICS' MAGAZINE, which is circulated in several foreign countries. He is thus debarred from several patents, and this is more especially the case, if we happen to have illustrated the new patent. Patentees intending to apply for foreign patents, often come to our office and request us not to illustrate their inventions, for this very reason. Of course we always accede to this request, as we should be very sorry wilfully to cause an injury.

The intending patentee finds out that it is scarcely possible to get a patent at all in Prussia. He finds that a patent is absolutely refused him in some of the British colonies—Canada, for instance. To obtain a patent in any foreign country, he must be quick; he must lose no time; as in several countries interlopers are allowed; and in no case, except America, will a foreign patent last longer than his British patent. In fact, an English inventor, intending to apply for foreign patents, must make arrangements for this purpose, at least two months previous to his British specification being filed.

After having obtained the foreign patent, in whatsoever country that may be, he discovers that he is everywhere, except in England and America, obliged to put his patent to work within a time, generally varying from a year to two years. The foreign Legislatures seem to be possessed with the idea that a man will go to the expense and trouble of a foreign patent for mere pleasure. A delay in working a patent will often take place from reasons quite independent of the will of the inventor. He may be poor, or his invention may bear upon manufactures already in the hands of large companies, who, refusing to take the invention up, have only to wait a year or two for it to fall into their laps. We have shown, in our preceding article on this subject, the difficulty of getting a new thing quickly and truly appreciated. This cause also comes into play.

Upon the question of importing a patent, we will cite a portion of the evidence of Mr. A. V. Newton, before the Parliamentary Patent Law Commission of 1851:—"That is a great difficulty; (in introducing new processes) it requires a party who has a great interest in it to break down the prejudices, and that is more or less necessary in the introduction of every invention: the more trifling an invention may appear to be, the less difficulty there is in introducing it; the more really valuable and important it is, the more necessary it is that there should be one party who shall have a large interest in it, and be able to give the whole of his time and attention to pursuing it. I know of many inventions which I consider, as far as I am able to judge, of immense value, which have yielded nothing, and, perhaps, will never remunerate their inventors, owing to their totally neglecting them, and I question very much if they will yield anything to the public either. There is another reason why I consider the clause, which affects the importation of inventions into this country, to be so objectionable, and that is, that English patents, when granted for native inventions, may be invalidated by evidence brought from a foreign country, that the invention was not new at the time of granting the patent. I think that that is the strongest objection, or, at least, as strong an objection to this clause as any former objection. No man, in this country, patenting an invention can be sure that he has a valid patent; it is an impossibility to satisfy himself upon that subject; and I think that, if for no other reason, that clause will be extremely injurious, because the patentee will then have all the world against him, as it were; whereas, now, he has only the parties engaged in the same trade as himself in his own country."

Of course, an international convention for the securing of intellectual property would be very difficult to bring about. By one of those coincidences that only occur during a lapse of centuries, the three nations in the van of civilization, namely, Great Britain, France, and Prussia, are now engaged in reforming their patent laws. Never will such an opportunity again occur of bringing about an international convention as to the laws of intellectual property. America has just lately reformed her patent laws. The old law embodied a rough attempt at reciprocity. International treaties already exist as to property in art designs, trade marks, and copyright.

The British laws bearing upon copyright and patent right merge in a remarkable way into each other. Copyright, however, is not the same as patent right, inasmuch as the author of a book cannot forbid the world to borrow his ideas, although he may forbid people to copy his ideas in the tangible way into which he has put them. We mean that he may prevent his book being published. We will, however, cite what *The Times* wrote in 1851 about copyright, as the meaning adopts itself very well to an international patent right. *The Times* is just now the chief opponent of patent right, so that it is not inappropriate to quote it against itself, although *The Times* may thus find an application of the well-known lines:—

> "That Eagle's fate and mine are one,
> Which, on the shaft that made him die,
> Espied a feather of his own,
> Wherewith he wont to soar so high."

"The most hopeless subject of negotiation with the Governments of other countries has long appeared to be an international copyright law. Intellectual "produce" has been the only description of goods excluded from equitable conditions of exchange. With regard to hogsheads of sugar, bags of coffee, and bales of cotton, there could exist no rational doubt that, sooner or later, the commercial transactions of the world would be placed on a rational footing. The advocates of exclusion and monopoly invariably fabricated an economic system in accordance with their own views, and endeavoured to invest it with the most fascinating attributes of philosophy and justice. There was error in their calculations; but it was error under the colour of reason, and wrong under the semblance of right.

"The property in intellectual works has been regarded from a different point of view. The various Governments of Europe, and of the United States of America, have, from time immemorial, declared that a work of literature or art, the property of a single individual in a single nation, was a fair mark for piracy and theft. Genius has been outlawed. The property it should have owned, whether in its most splendid or most trivial productions, has, by the comity of nations, been treated in the same way as the goods of a convicted felon.

"All this has been done in the broad light of day, under the sanction of the most distinguished statesmen of the most civilized nations of the world. Ignorance must not be pleaded in bar of the indignation which such a policy is calculated to inspire in any mind not destitute of the first impressions of right and justice."

There are already international conventions for protecting intellectual property in literary and art produce. Now a patent often protects a product that embodies a triad of scientific, artistic, and practical merits. A true engineer has the brain of a scientific man, the heart of an artist, in inventing and putting his invention into an elegant shape, and lastly he stands on the strong legs, and works with the skilled hand, of the artizan. Every sound art stands on a mechanical trade for its basis.

Although it is the case, that the merit and difficulty in inventing are very great, nevertheless it is a great mistake in legislation to give a patent for any scientific combination as a reward of merit only. Every man in the possession of a sound patent is a kind of trade missionary, preaching and exhorting people to reform expensive and laborious ways of manufacturing.

We know, from very competent authority, that, during the last harvest of 1862, the scarcity of labour in Spain was so great, that the harvesters were paid extremely high wages—wages that would be enormous even in England. In fact, we should be afraid to state what these men got. In some districts much grain was spoilt. Nothing of this could have happened if a good reaping-machine had been already introduced into the country.

We believe that Mr. M'Cormick is now engaged in introducing his well-known reaper into Spain.

It is remarkable that the nations the most advanced in industry, such as Great Britain, America, and France, are at the same time the most liberal in their patent law legislation. The nations that are most in want of progress and of help, such as Turkey, and to some extent also Germany, are the most retrograde and narrow-minded in encouraging patent rights.

What we propose as the basis of future cosmopolite legislation would be that "*all inventions and discoveries should be accepted as new in any given country which had not been worked in that country for the last twenty years.*" A further clause, giving a preference to the original inventor or discoverer, could easily be inserted.

Such an international convention, or assimilation of patent right, throughout the different nations, would act as a bond between the most active and powerful spirits of the age. This would, indeed, be FREE TRADE in inventions. We will conclude this notice on an extensive subject, in the words of that Prince of Science and of men, who has just passed from among us. They were spoken by Prince Albert, at the famous Exhibition Mansion House banquet of 1850:—

"Nobody who has paid any attention to the peculiar features of our present era, will doubt for a moment that we are living at a period of most wonderful transition, which tends rapidly to accomplish that great end to which, indeed, all history points—*the realization of the unity of mankind.* Not a unity which breaks down the limits, and levels the peculiar characteristics of the different nations of the earth, but rather a unity, the result and product of those very national varieties and antagonistic qualities.

H.

SUCKING AND BLOWING THE MAIL.

JUST two hundred and eight years have elapsed since the then Burgomaster of Magdeburgh, Otto von Guericke, invented the air-pump, and astonished the Emperor of Germany at Regensburgh, by exhibiting the apparatus in action. By means of his contrivance he exhausted a tube wherein a piston was fitted and made to slide easily, and thus raised a heavy weight to a considerable height. Since the time of the ingenious and scientific Burgomaster—who, it is some satisfaction to say, had previously been a student at Oxford University—many efforts have been made to employ atmospheric pressure in the performance of mechanical, and industrial operations. These efforts have, for the most part, proved failures, commercially or practically, and we really have not succeeded to any extent as yet, in pressing the atmosphere into active service. Everybody remembers the various railway schemes on the atmospheric principle which, from time to time, have occupied the attention of our cleverest mechanics, and all know that they have been abandoned. Mr. Brunel tried the system in South Devon until the patience of the shareholders with whom he had to deal was exhausted more completely than the propelling tubes of the railway ever was by the application of his gigantic pumps, and then the whole of his costly apparatus was sold as old iron. The Kingstown-Dalkey atmospheric line maintained its ground longer than any other, but it at last yielded to the Locomotive, and has ceased to exist. These are certainly far from being encouraging facts, but they assuredly will not deter other inventors—worthy disciples of Otto von Guericke—from perseverance in the same direction. For their comfort, it may be mentioned, that in one remarkable instance, at least, atmospheric pressure has been made subservient to mechanical art, and is employed efficiently and economically. The Coinage of the British Empire is stamped entirely by its force. We have not space nor time at present to enter into a description of the beautiful arrangement of air-pumps, vacuum chambers, levers, springs, and valves, by means of which impressions are given at the Mint, with rapidity and precision, to the coins which issue from that establishment. It must suffice to say that the air we breathe literally coins the money we use, and that therefore there is yet hope for atmospheric engineers. It is now proposed to make the atmosphere our General Postman, as well as our Chief Coiner, and we cannot see any practical obstacle to its becoming so. The only doubtful point—and it is one which actual experiment can alone solve—is the commercial one. That atmospheric pressure may be made to transfer letters and parcels by wholesale from the Land's End to John o' Groats, is a certainty. That its employment, in lieu of other modes of transit, will effect advantages in a pecuniary sense, is another question. The Pneumatic Despatch Company, which has now been in existence some two years, answers the important query affirmatively; and on a comparatively small scale they are essaying to demonstrate the truth of their views.

On a piece of waste ground, the property of the North-Western Railway Company, and to the right of the carriage entrance of the Euston station, the would-be atmospheric letter carriers have erected their first pneumatic apparatus. An engine-house—for steam is the prime mover after all—has been built on the spot named, and this shelters an engine of some 20-horse power, with boiler and appurtenances, together with a gigantic disc of some 21 ft. in diameter, and which is hung upon the horizontal crank shaft of the engine. This disc, which is hollow and of wrought iron, is virtually an air pump, and it is divided into a number of small chambers. When the disc is in motion, these, like so many mechanical fans, gather air at the centre and emit it at the circumference. It is intended that this centrifugal disc shall make 300 revolutions per minute; and as its centre is to be in direct communication with the interior of the conveyance, or vacuum tube, it is clear that this latter may be exhausted to an extent governed by the speed of the disc, and the weight on the relief or regulating valve opening into the tube. The tube itself consists of a series of cast-iron socket-ended pipes in 9 ft. lengths, jointed together with molten lead, and resembling in sectional forms the old-fashioned waggon-ended boiler of Watt. The height of the tubes, from floor to roof, so to speak, is 2 ft. 8 in., and their width also is 2 ft. 8 in. The upper part or roof is semicircular, whilst the lower part is nearly flat. Along the two sides of the base of the tube run narrow longitudinal flat surfaces formed in the castings, and these constitute the tramway upon which the carriages are to travel.

The carriages themselves are made of stout boiler-plate. They are about 4 ft. 6 in. in length, have a deep hold for the reception of their cargo of letters, parcels, merchandize, and are each mounted on four small wheels of cast-iron. The carriages are of the precise form of the tube, and though they by no means fit its interior closely, they yet may be said to represent pistons. About a quarter of a mile of this tubing has been laid down, and it connects the engine-house at Euston with the North-Western District Post-Office in Eversholt-street, Camden-town. At each end of the conveyance pipe, as we may henceforth term it, an iron cover of sufficient area to seal its mouth is hinged. These covers have been faced in the lathe, and, when lying on their diagonal seats, form air-tight joints. Such are the main features of the apparatus of the Pneumatic Despatch Company, as at present established, and almost perfected for trial at the place indicated.

It will now be understood, if our explanation is sufficiently lucid and minute to make it so, that it is quite possible to pump the air from the conveyance pipe. Well, then, supposing it be desired to transfer a loaded carriage from the Post-office to the railway station, it will be simply necessary to push it (the carriage) forward on rails corresponding with those in the inside of the tube, close the engine house end, start the disc, remove the air from the front of the carriage, and allow the external atmosphere to push it forward to its destination. The speed at which it will travel will depend on the extent of the vacuum, which is again determined as we have described. This operation may be justly termed "sucking" the mail.

It may seem strange to some that the carriages do not fit the pipe, and the possibility of forming a vacuum at all, under such circumstances, might well be questioned; but the answer is, that the area of the end of the carriage is great, the vacuum low, and the air-space or windage, consequently, not sufficiently large to allow of the "killing" of the vacuum by the rush of air through it. The atmospheric pressure will not, as a rule, exceed 5 lbs. on the square inch.

At the head of this paper we speak of "blowing" the mail, as well as sucking it. This operation the Pneumatic Despatch Company propose to do by inverting the action of the disc, and causing it thus to force or blow air *into* the conveyance pipe, instead of pumping it *out*. It is evident that it is as necessary to be able to send parcels, &c., from Euston to Eversholt-street, as to despatch them from Eversholt-street to Euston. This can only be done by erecting an engine and accessories at the Post-office, as well as at the station, or by *blowing* the carriages one way, and *sucking* them the other. We are of opinion that in the *blowing* part of the process failure awaits the company's exertions. The power required to displace the air in front of the carriages, and move them at any speed, will be very great, and the cost of doing it excessive—at least, we think so. It would be much more advantageous to continue the conveyance pipe to a greater distance—say, some four or five miles, even to the General Post-office, and then erect "sucking" apparatus at both ends. No doubt the transport of the Camden-town machinery from Battersea-fields, and its re-erection, have been attended with considerable expense, as we know they have with much difficulty. The laying of a large tube at a depth of four or five feet below the surface of a street—that street being already occupied by a net work of gas and water mains, with their connections—is in itself no trifling task. It is to be trusted that final success will repay the shareholders for the labour and the money which have been expended. It may be stated, finally, that the nonfitting of the carriages enables them to pass freely over steep gradients and sharp curves, which is fortunate, for these will have frequently to be encountered in laying conveyance pipes through the great thoroughfares of London. Messrs. Rimmell and Clarke are the engineers, and James Watt and Co. constructed the engine and machinery.—*Building News.*

Dr. Hutton estimated that the first force of gunpowder is equal to 30,000 lbs. on the square inch, and Robins computed that the velocity of expansion is about 7,000 ft. per second.

LONDON FIRES.

Captain Shaw, the successor to poor Mr. Braidwood, as Superintendent of the London Fire Brigade establishment, has just issued his annual report to the General Committee of the twenty-eight Fire Insurance Offices in union for the Suppression of Fires in the Metropolis. The document is very important and instructive; would that we could say, also, with some of our contemporaries, that we think it "satisfactory." It is, on the contrary, difficult for us to find anything at all in Captain Shaw's report which would justify such an expression. It seems that during the year 1861 no less than 1,303 fires, some of which were of an extremely destructive character, occurred in the Metropolitan Districts. This gives an average of rather more than three fires per night, twenty-five per week, or one hundred and eight per month. Surely this is not "satisfactory!" If we institute a comparison between the number of fires in some previous year, say, 1833, for example, we shall find that even taking altered circumstances into account, the results will be very *un*satisfactory. In the year last named, the number of fires in the same districts, as reported by the then superintendent of the brigade, was just four hundred and fifty-eight. This gives an average of little more than one fire per night, nine per week, or thirty-eight per month.

Is not this simple fact an overwhelming proof of the totally inadequate means at our disposal at present for the suppression of fires? It will, perhaps, be said that the house, area, and the population of the Metropolitan Districts have grown very considerably during the intervening thirty years, and that, therefore, a larger number of fires may now be reasonably expected to take place. This may appear, at the first blush, to be a tenable, if not a feasible, explanation of the sad increase in the number of fires recorded in the year which has just passed. A cursory examination of the argument will probably demonstrate its groundlessness. It is perfectly true that the progress of building in and near London since 1833 has been very extensive, whilst the last Census demonstrates the existence of a vastly increased population. This growth, however, has been gradual, and patent to all. Ought not, then, the numerical strength of the corps organised to combat with the "destructive element," and the means and appliances with which they are armed, to have grown in a proportionate ratio?

Since the year 1833 enormous strides have been made in mechanical knowledge. Steam power has become almost universal in its application, while science has opened up its "ample page" and enabled us to imbibe lessons which have been turned to much practical account. Should not these advantages have placed us in a far more favourable condition for overcoming fires? If the metropolitan districts are more completely built upon, and more densely peopled, ought not corresponding precautions to have been taken against the increased risk? At least, we ought not to be in a worse position in those respects than we were thirty years since. The per centage of fires, to houses and population in 1861, is much higher than it was in 1833, and this with all our boasted improvements in the construction of dwellings and warehouses, increased mechanical skill, and extended knowledge of the laws of Nature. Surely, then, there must be a fault somewhere. There must be a reason or reasons for the deplorable and alarming state of insecurity in which the inhabitants of London now find themselves in regard to fires.

The Seasons seem, according to Captain Shaw's report, to have little to do with the increase or diminution of the number of fires in London. It was once the popular belief that winter was most fruitful of those disasters. The tabulated monthly summary of fires for last year dissipates that delusion. Destructive fires are now in season all the year round, and in 1861 the greatest number, 136, took place in the month of August, whilst the minimum, 86, was attained in October.

Without going at present more minutely into an analyzation of the document in question, it must be permitted us to say that it constitutes, as a whole, one of the most convincing arguments that could be adduced in favour of a total reformation of the London Fire Brigade, and a transference of its management to other hands.

It is true that the Superintendent points exultingly to some changes which have been effected since his Accession to power, and those changes have certainly tended in the right direction. They are, nevertheless, but inklings and foreshadowings of the great and sweeping changes which are to come.

We are told that "in the steam department a considerable increase has been made, and that, at least, one land steam-engine is available at almost every fire. Telegraphic communication has been established between the Central Station and those occupied by the firemen of the districts." This arrangement, we remember, was strongly urged, in June, 1861, in the Mechanics' Magazine, by Mr. Newton, of the Mint; and we are glad to see that it has been so promptly carried out. Captain Shaw testifies to its value in the following words:—"It is impossible to over-estimate the advantage of the telegraphic mode of communication, which, though it has only been a few weeks in operation, has already been the means of saving a large amount of property, and, moreover, assists me very materially in carrying on the daily and hourly duties of an establishment which is, necessarily broken up into a number of fragments and distributed over a large area." The numerical strength of the brigade has been increased by the addition to its ranks of 14 men, and it now numbers, in all, 130.

In conclusion, we can only trust that during the coming session of Parliament the recommendations of the Select Committee of the House of Commons, which reported last year in favour of a great extension of the Fire Brigade, and the placing it under the control of the Metropolitan police authorities, will be adopted. It has been a serviceable institution in its day, and may yet form the nucleus of a much-extended and more perfect one—one organised, controlled, and in all respects appointed so as to meet the wants, and satisfy the just expectations, of the residents of the Metropolis of the World.

Proceedings of Societies.

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ROYAL SCOTTISH SOCIETY OF ARTS.

The third meeting for the session of the members of the Royal Scottish Society of Arts was held on Monday night, at Edinburgh. Dr. Stevenson Macadam, president of the society, in the chair.

Mr. **George Russell**, engineer, St. Vincent-street, Glasgow, gave a description of an improved riveted joint applicable to iron ship-building, girders, bridges, &c. The improvement proposed by Mr. Russell was to arrange the rivets in the form of an equilateral triangle form each side of the butt, making the covering plates of the form of a parallelogram made up in form of two equilateral triangles, having a common base. The paper was remitted to a committee.

Mr. **J. M. Balfour**, C.E., gave a description of a simple improvement on reflectors for light-houses. The improvement consisted in the use of a plain horizontal reflector, in combination with another of a parabolic section. The reflector was fitted with an auxiliary tube, and from experiments which he had made, he had observed a considerable increase in brightness and in the apparent size of the light. This paper was also remitted to a committee.

The report on Mr. Warner's "Stereometric Tablet," for facilitating the computation of the solid contents of railroad excavations and embankments, was to the effect that the committee considered it an ingenious and scientific attempt to lessen the heavy labour of railway computation.

The committee which was appointed to consider Mr. D. Campbell's communications on sulphuret of iron, as a cement for fixing iron railings, &c., reported that, to the best of their knowledge, Mr. Campbell's use of sulphuret of iron for this purpose was quite new, and, at the same time, a great improvement on all former cements used for the same purpose. The committee recommended Mr. Campbell's communication to the favourable consideration of the Prize Committee.

The following gentlemen were admitted members of the Society:—Messrs. David Craig, papermaker, Portobello; James Andrews, C.E., George-street; R. W. Thomson, Moray-place; Peter M'Lagan, of Pumpherston; J. A. Mackay, of Blackcastle; and George Blanshard, wholesale druggist, Carlton-terrace.

ROYAL GEOGRAPHICAL SOCIETY.

The Atlantic Telegraph.

An interesting meeting of this society was held on Monday evening last; Sir Roderick I. Murchison, president, in the chair.

Dr. **G. C. Wallich** read a paper on the question of a Survey of the Physical Condition of the Atlantic, preliminary to the laying down of another electric cable connecting Europe with North America. Dr. Wallich began by pointing out that both the amount and kind of information we now possessed regarding the deep-sea bed of the Atlantic were altogether inadequate to meet the requirements of oceanic telegraphy. Referring, in proof of this, to the line of soundings taken by Captain Dayman, in 1857, on board her Majesty's ship "Cyclops," he observed that these, though as perfect as circumstances then allowed, furnished data necessarily incomplete; inasmuch as only 41 soundings were taken at depths exceeding 250 fathoms, across an area of 1,300 miles of ocean, leaving a mean interval of 32 miles between each two soundings. Having assigned his reasons for disbelieving that the entire central basin of the Atlantic is, as many have supposed, a vast plateau, unbroken by alternations of level as great as those existing on land, he observed that in the intervals between the previous measurements of the depth of the ocean-bed some of the largest mountain ranges might very well be included—a matter obviously most important, as bearing upon the safe laying of a telegraphic cable. True, no such submarine slopes had hitherto been detected in the mid-Atlantic, but the *data* on which it was assumed that they did not exist there were, he maintained, purely arbitrary. A sounding of 100 fathoms had been taken by Lieutenant Sainthill, R.N., within about 32 miles of one of 3,000 fathoms, taken by Captain Dayman. Dr. Wallich then enumerated the various kinds of observations that he thought essential to a trustworthy telegraphic survey, among which was a method of probing the deposits of the sea-bed, with a view to determine their geological character. He exhibited an ingenious instrument, designed by him to effect this object, besides other new apparatus for raising specimens of water from any desired depth, and for gauging the pressure at all depths. Passing to the means requisite for carrying out his survey, Dr. Wallich recommended that the Government should equip two steam-ships for the work; the great novelty of his plan consisting in the two vessels sailing in parallel courses, removed only 2 miles from each other, and the soundings being taken alternately on each line of the longitudinal belt thus defined. While, therefore, there would be an interval of 5 miles at the utmost between any two soundings on the same line (that was, taken by the same ship), there would be an interval of only 2½ miles between those on alternate lines. Having indicated how a minuter inspection of doubtful or dangerous areas might easily be effected, he suggested that Captain Dayman's line of soundings should form, as it were, the base of operations, and be taken as the centre of the 2-mile longitudinal belt which he proposed to have surveyed. The entire work might, he thought, be finished in five or six months. Summing up the advantages of his plan, he remarked that it would furnish no less than 640 reliable observations, extending across the entire deep water of the Atlantic, and affording a basis upon which its whole sea-bed might ultimately be mapped out. In conclusion, he said the task was unquestionably arduous. Its execution might prove costly and tedious. But there it was, staring us in the face—a task which we must either manfully grapple with and master, or leave unfulfilled to our successors the accomplishment of the grandest international project that human sagacity had heretofore suggested. The paper was listened to with marked interest, and repeatedly applauded.

The **President** reminded the meeting that Dr. Wallich accompanied Sir Leopold M'Clintock in his North Atlantic explorations, and had since published a valuable work on the natural history part of the exploration. In his elaborate paper he had thrown some light on the nature of the animals existing at the bottom of the sea, and on the varieties of soils, and even subsoils, that were to be found there; for with the ingenious apparatus which he had explained, he was able not only to tap the soft strata, but even to bore into the solid rock. The survey which he proposed was a preliminary one, and essential before any attempts were made to lay down a telegraph cable across the Atlantic. At all events, whether any adventurous persons chose to undertake that preliminary survey, it became us, as a great maritime nation, to ascertain as accurately as possible the condition of the bed of the ocean between England and America, with the view to telegraphic communication being established.

Sir Edward Belcher, R.N., as the senior surveying officer present, thought it is duty to answer some portion of the paper. Such a project as Dr. Wallich proposed would answer very well across the Irish Channel; but from his experience in searching for shoals even within 100 yards of his own ship, for six weeks and fourteen hours a day, he knew the difficulty of finding a rock, not much larger even than the President's chair. Any such survey, therefore, would cost an immense sum of money, would incur more labour than the men would like, and would be attended with innumerable difficulties, which would render the carrying out of such a project absolutely impossible. For a telegraph cable, it was not the deepest water that was wanted, but a line of bottom which would give mud and avoid mountains; nor did he think many scientific men were of opinion that it was desirable to carry a cable straight across the Atlantic. If they carried the line from the Hebrides or the Orkneys to the Faroe Islands, and so on in that direction, a simple mode of being sure of what they were about would be secured; they would know, with such small lines, positively what bottom the cable would lie upon. To carry a cable from point to point might be done at a small expense, and in that way they could feel their way across the ocean. With reference to the apparatus explained by Dr. Wallich for sounding the bottom of the ocean, he might state that in the soundings which he carried on, in 1835 and 1836, a very accurate instrument was used, not only for sounding, but also for determining the temperature at different depths, and bringing up the water. He explained the construction of that instrument, and stated that it was in use for a period of twelve years, without the slightest derangement of even the delicate thermometers that were attached to it. He thought, before the Government was moved to incur the cost and labour of carrying a line of soundings across the Atlantic, the opinions of scientific men should be taken as to whether it would not be better to have several stations for the cable, instead of one long line.

Admiral Elliot doubted whether the survey proposed by Dr. Wallich would render them any wiser with regard to the laying down of the Atlantic cable, because it was impossible to thread their way across the ocean in the way Dr. Wallich supposed, and avoid mountains and hollows that might be found to exist. Nor did he think such a method of sounding practicable: and to keep the laying of the cable in abeyance till it was accomplished would be inexpedient.

Professor Tyndall said, as far as the physical objects indicated in the paper were concerned, he did not think they were of sufficient importance to justify any great outlay. He confessed he had arrived at a conclusion somewhat in accordance with that of Sir Edward Belcher and Admiral Elliot. Even if Dr. Wallich's survey were carried out, it could not, with five mile intervals, give an accurate view of the bed of the ocean; knowing what we did of the variations that occur within five miles on the earth's surface, how easily such a projection as that of the Matterhorn might be missed.

Captain Selwyn, R.N., said the diagrams of soundings taken by Captain Dayman, R.N., not having been thoroughly understood, had given rise to the supposition that there was a precipice off the shores of Iceland. He had been engaged, in company with an officer of the Admiralty, to measure the exact distance between the soundings and the depths, and they ascertained that the fall on the bank in question was not greater than that of Holborn-hill. No one would imagine that a cable would be injured by such a descent as that, nor that there were precipices so abrupt as to hold the cable on the stretch between them. Again, it was utterly impossible to find out whether abrasion would be caused, and it would be combatting with theoretical difficulties to delay laying the cable until the exact character of the bed of the ocean between England and America had been thoroughly determined. With respect to the best route, he could suggest a shorter one by 300 miles, by taking the cable to the Flemish banks, 300 miles this side of Newfoundland, where the depth varied from 30 to 200 fathoms. He also thought that the proper method of survey would be to adopt the system of triangulation.

Mr. Webster argued that the laying of the cable would of itself enable us to obtain a knowledge of the bed of the ocean much more effectually than by any survey.

Dr. Wallich briefly replied, defending his plan from the objections that had been urged against it, and adducing further reasons against the adoption of the counter telegraph-route suggested by Sir E. Belcher.

The meeting was then adjourned to Monday, the 26th January.

SCOTTISH SHIPBUILDERS' ASSOCIATION.

On Monday week this association held their usual monthly meeting in the Queen's Rooms; J. G. Lawrie, Esq., vice-president, in the chair.

A letter was read from the Deputy-Chairman of Lloyd's Committee, requesting the association, as a body, to favour the committee with their views on "Lloyd's Rules for the Construction of Iron Ships," preparatory to an amendment which is now considered necessary, from the increased experience of shipbuilders and the committee in the construction of iron vessels. The committee has, already, requested the shipbuilders individually all over the kingdom to submit any suggestions that they might consider advisable; but, for the purpose of meeting the request of the committee to the association in a friendly spirit, and furthering the object contemplated, the association appointed a committee to draw up and submit such suggestions as the association may deem most advisable for the improvement of the construction of iron vessels.

Mr. R. Duncan, of Renfrew, then read a paper explanatory of an improved slip dock, and also of a self-acting tide-gauge, by which the exact rise and fall of tide for any height, from 1 foot to 100 ft., could be registered with the greatest precision for any length of time. Mr. Duncan's models received honourable mention from the jurors of the International Exhibition; and having in the handsomest manner presented them to the association, he kindly consented, at the request of the council, to favour the association with a description of the principles and improvements embodied in them.

Dr. James Gray next exhibited and described a plan for cleaning the bottoms of iron vessels, and preventing fouling. It consists of an ingenious application of pulleys, lines, and brushes, for sweeping the bottom from the water edge to the keel, whether the vessel were at rest or at sea.

Considerable discussion followed the reading of both papers; and the thanks of the association were awarded to Mr. Duncan and Dr. Gray for the able and earnest manner in which they had studied and treated their respective subjects and laid them before the association.

ENGINE ROOM TELEGRAPHS.

We informed our readers, some two or three years ago, that an order had been issued from the Admiralty to the effect that all vessels of war, except gun-boats, were to be fitted with engine-room telegraphs. We also remember drawing attention to a series of experiments in 1858 and 1859, which had been instituted by the late surveyor of the navy and the Admiralty, and which extended over a long period, no expense having been spared in the matter. These experiments were made under the direction of one of their Lordships' most experienced officers, Capt. Halsted, and other officers of the steam reserve at Sheerness, in order to procure the most efficient and reliable means of communicating the orders of the captain from the bridge, &c., to the engine-room. Makers of such instruments were called upon to fit each one his own apparatus to certain ships, to be tested according to a series of moves and workings as to the relative mechanical efficiency and workmanship. It may not be out of place to mention the names of the several competitors (see *Mechanics' Magazine* of May 27, 1859). The greatest number of perfect marks and working was attained by Mr. T. Suffields, of Bermondsey-wall, who obtained 600 marks. Mr. A. P. Hows, and Mr. Hornseys came next; and, lastly, Messrs. Allen and Crispens obtained about 150 marks. Of those that were indifferent or bad, Suffields alone registered none.

The late surveyor, coinciding with the expressed opinions and reports of the officers of Sheerness yard, issued orders for a number of the most successful telegraphs to be fitted to line-of-battle ships. Now, however, strange to relate, after a lapse of three years, in order, as it is termed, to "economise," and "other reasons, to be afterwards named," their lordships seem to have adopted several of the most unsuccessful instruments. These measures have, therefore, been naturally causing some comment, not only only from the officers concerned, but from practical naval engineers.

Evidence can be produced of the failure of an instrument constructed on the principle of common cranks and wires, &c., by which means the Admiralty are now endeavouring to communicate those important orders that are interchanged between the captain to the engineer. Every householder knows the liability of his bells, cranks, and wires to failure. Then what must we expect when such apparatus are fitted to line-of-battle ships, &c., labouring and working at sea? No wonder the officers express surprise at being compelled to rely upon what they know to be so liable to error. One of these instruments, at a late trial, completely failed in the presence of a high official at the Admiralty, which failure was, however, hushed up.

The Lords of the Admiralty, says the *Times* of Tuesday last, "have directed plans to be prepared by which boats' falls may be led in board and secured to bollards, so as to ensure a rapid and uniform lowering (of boats) when required." So much for the encouragement of mechanical science at Whitehall! While the use of blocks and falls have long since been discarded at every dock, wharf, or building-yard in the county for lowering goods or merchandize, from the constant liability to accident arising from the large quantity of rope or chain they employ, the Lords of the Admiralty are now setting their officers to work to improve these primitive contrivances, which the rest of the world has long since superseded by others altogether superior in mechanical action. We need no stronger official admission than this of the inability of the detaching hooks, in conjunction with the falls, (lately ordered to be fitted exclusively in the ships of the royal navy, as commissioned), to accomplish the ends it has been pretended they effect, viz., a safe and rapid lowering of the boats. The principle commonly employed for lowering all other heavy weights must hold good for lowering boats, and the one single part of rope or chain must eventually supersede the quadruple combination of former days, that their lordships are now uselessly setting their officers to puzzle their brains to make the best of, and which, if accomplished, will only exhibit the naval world behind all others in its application of mechanical science, to overcome simple mechanical difficulties. "How not to do it" never had a better illustration than the tortuous process the Admiralty has employed of late years for finding out the correct principle by which to lower ships' boats safely. When more victims have been sacrificed, "their Honours" may at last discard the blocks and falls, and poor Jack have the safer and readier system of lowering his boat, with its living freight of human beings, that every builder or wharfinger has long since used for the greater security of his logs of timber or his flour barrels.

On Thursday fortnight a mixed train started on the Great Eastern Railway from Newmarket for Cambridge. It had not proceeded far on its journey when it was ascertained that one of the goods' trucks was on fire. The guard *being unable to communicate* with the driver, three miles were traversed before the train stopped. The guard then contrived to uncouple the burning truck, and the engine dragged it swiftly away to the next station, but before it arrived there it was nearly consumed. Unfortunately, a passenger carriage had been attached to the truck, and the passengers were for some time in an alarming position.

GRIFFITHS' IMPROVED PROPELLER.

Mr. Robert Griffiths, of the Mornington-road, Regent's-park, has just patented an improvement in screw propellers for ships, which consist, first, in constructing the propellers with the blades and centre boss of similar form and construction (or the blades may be cast on the boss) to those described in a former patent, dated 20th February, 1858, but having four blades (or two sets of blades), which are to be fixed either to the same boss, or to separate bosses on to the screw shaft, and so fixed that one set (or pair of blades) is placed before the other set, the first set or pair of blades next the shaft to be of larger diameter than the after set, so as to get a greater hold on the water for propelling the ship.

Fig. 1 of the accompanying engravings shows a screw propeller arranged as above described, the two pairs of blades *a* and *b* being affixed to separate bosses, the boss *a* of the pair nearest the stern of the vessel being fixed upon the screw shaft, whilst the boss *b* of the hindermost pair of blades is loose thereon, and is coupled with the boss *a* by projections, which enter grooves or recesses formed around the boss *a*.

The second part of this invention relates to side wheel propellers, which is constructed of discs of suitable diameter, having the centre parts constructed with arms and centres similar to those generally used for paddle wheels, but having the outside rims of such discs corrugated or in a zig-zag form, instead of being flat, in order to offer sufficient resistance when driven through the water to propel the vessel. Either one or a series of these discs or wheels can be used on each side of the vessel as may be required to propel the ship, or the outside rims may be made flat, and the inside rims only be made corrugated or in zig-zag form.

Figs. 2 and 3 show a side view and plan of a side wheel propeller so constructed. *a*, *a*, are two corrugated metal rims combined and rivetted together, having narrow spaces between them, and supported between the two flat outer rims *b b*, attached by arms to the centre boss fixed on the main shaft or axis *c*.

GRIFFITHS' IMPROVED PROPELLER.

FIG. 1.

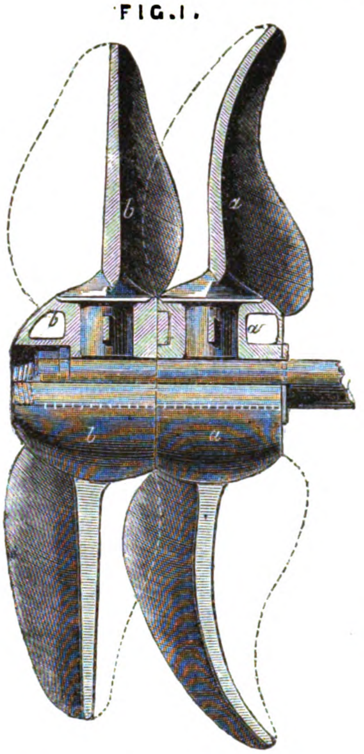


FIG. 2.

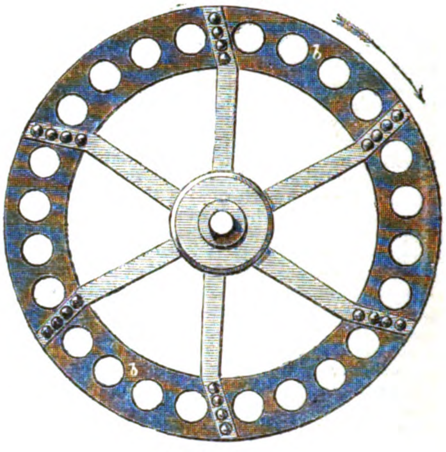
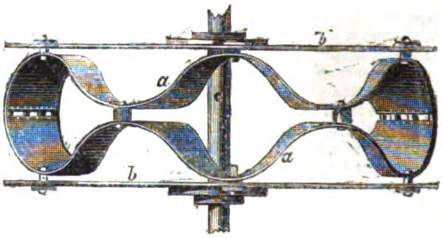


FIG. 3.



HORNSBY AND SONS' NEW TURNIP CUTTER.

Provisionally protected December 4th, 1862.

We gave last week some illustrations and a description of the root pulper, first exhibited by the above well-known Grantham firm, at the last Smithfield Club Cattle Show. They also exhibited a turnip cutter at the same show.

The new turnip cutter of Messrs. Hornsby and Son, shown in the engravings, is composed of a revolving disc wheel, having angle knives (commonly known as Gardner's) fixed on a bar, which is so curved, that the knives in cutting the roots tend to draw them to the centre of the disc, and as each knife strikes the roots in regular succession, the wedging between the knives (where they are placed in a V form) is thus obviated.

The disadvantage of the cut pieces having to pass through a cylinder before falling, and thus becoming discoloured, is avoided by the disc wheel, which is of sufficient size and weight to render a fly wheel unnecessary. The peculiar form of the hopper conducts the roots steadily to the cutting surface, and the grating allows the dirt or small stones to pass through before they come in contact with the knives.

By means of a patented flange on the disc, combined with a vertical board placed underneath the hopper, at such a distance that the knives will just pass clear, the last piece will be returned to the feeding hopper, so as to insure its being properly cut.

The machine is mounted on a strong wood frame, with improved iron hopper, and the working is equalized by the improved arrangement of the knives or cutting wheel, while, at the same time, it effectually cuts the last piece.

The knives are fastened to a bar which is bolted to the disc, so that they can be taken out either singly or collectively for sharpening. The usual knives for cutting pieces for sheep can be removed at pleasure, and slicing knives for cattle substituted when desired.

Fig. 1. A. Face side of disc.
B. The bar to which the knives G are fastened with a screw, each one separately.
C. The three bolts which fasten the bar to the disc.
D. The face plate or guard which the teeth F of the disc approach near enough to prevent the escape of the last piece.
E. The last piece.
B. E. and F. of Fig. 2 are the same as on Fig. 1.

HORNSBY AND SONS' NEW TURNIP CUTTER.

FIG. 1.

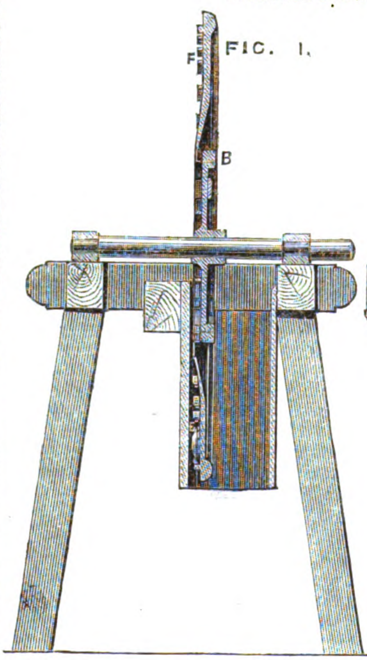
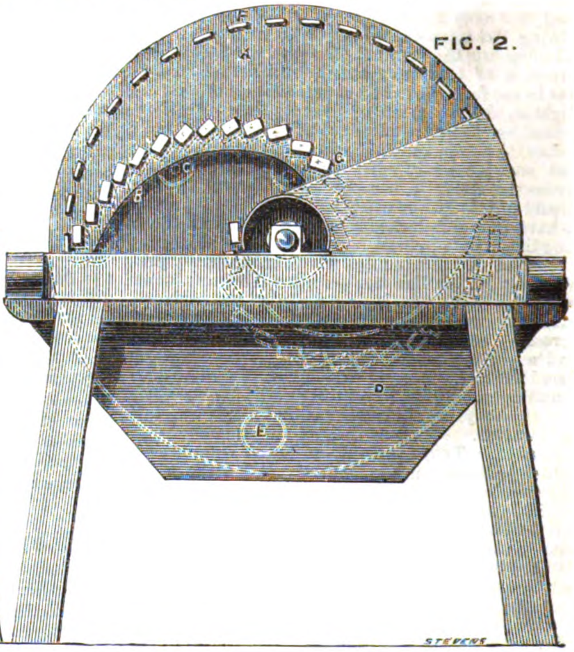
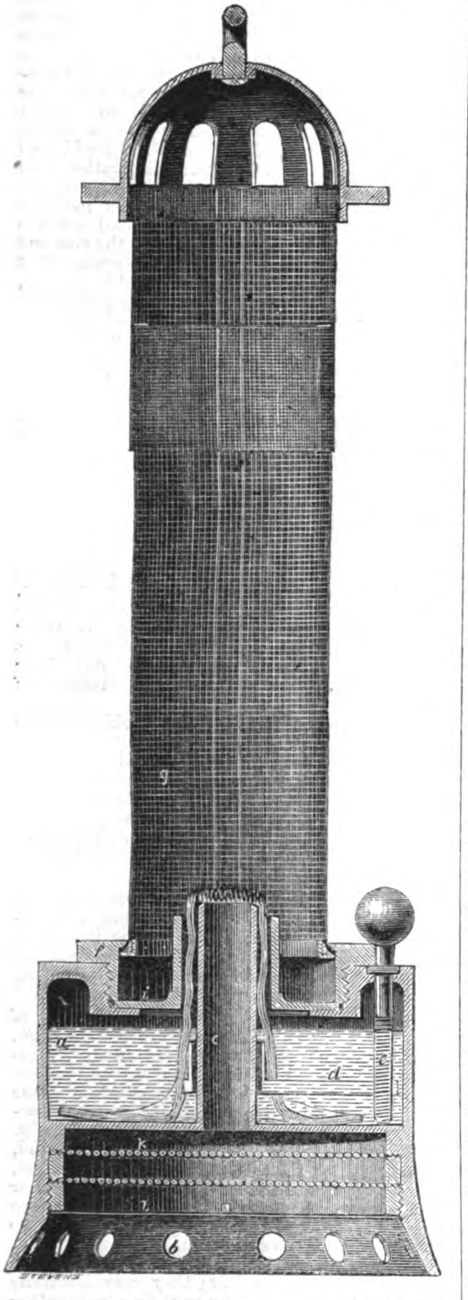


FIG. 2.



We last year published a review, and have since given extracts from Truran's valuable work on the iron manufacture. At Dowlais Ironworks, where Mr. Truran was employed, the weekly make of iron is about 130 tons, and the ordinary weekly amount of slag, 250 tons. The materials delivered weekly at the top of the furnaces would occupy 1,066 cubic yards. The air delivered in the same time by the tuyeres (*i.e.* the nozzles of the blast apparatus) weighs 1,695 tons and measures 50,550,400 cubic ft. Each ton of iron is reduced by 43·5 cwt. of carbon, and 388,800 cubic ft., or 13 tons of air. The weight of air is to the weight of material added at the top, as sixteen to seven. For each ton of liquid matter obtained (that is, including both iron and slag), no less than 129 cwt. of gases are evolved from the furnace.

HOWDEN AND THRESH'S SAFETY LAMP.



From our own experience we are inclined to assert that a great danger of the ordinary safety lamp consists in its giving such a poor light that the miner is continually tempted to open it, and obtain a light without the intermediate wire gauze. In the following lamp, as shown in vertical section, a hollow wick, upon the famous Argand principle, is used, whereby, of course, a much brighter flame is produced.

Instead of the ordinary solid wick, a tubular wick is used, making an air supply through the oil-chamber or reservoir as in the ordinary Argand lamp. Below the central opening in the oil-chamber are placed wire gauze diaphragms, set at a short distance apart, for the purpose of cutting off the communication between the interior of the lamp and the outer atmosphere. In other respects the lamp is very similar to those generally in use.

a a is the oil-chamber, the sides of which are continued downwards to form the foot of the lamp. A ring of holes, *b b b*, is made around the foot of the lamp to ensure access of air to the interior; *c* is an open tube extending upwards through the oil-chamber to near the level of the wick. Concentric with this tube is a wick-holder *d*, which is raised and lowered as desired by an adjusting screw *e*, which is supported by a shoulder fitting into the top of the oil-chamber. The middle part of the top of this chamber is recessed, and the edge of the recess has a screw cut upon it to enable it to receive a screwed collar *f*, which carries the upper part or cover of the lamp that surrounds and encloses the flame. This cover is composed, as usual, of a wire gauze cylinder *g*, with strengthening rods, and a cap *h*, to which the suspending ring is attached. Between the collar *f* and the top of the oil-chamber the nozzle *i* is secured, which with the tube *c* forms an annular space for the wick to pass up. The wire gauze diaphragms are shown at *k k*, situate immediately below the oil-chamber, and divided from each other by a loose metal collar. These diaphragms are held securely in place by means of a threaded ring *l*, which screws into a thread cut on the inner face of the foot of the lamp. Access is gained to the wick and oil-chamber by detaching the upper part of the lamp from the lower in the usual manner.

It will now be understood that the air to supply combustion will, when the lamp is standing on the ground, enter the holes *b* at the foot of the lamp, pass through the diaphragms, and up the central tube *c* to the flame. An ample supply of air will thus be ensured to the flame sufficient to keep up a large bright light, while at the same time the possibility of the flame igniting fire-damp outside the lamp is effectually avoided.

RANSOME'S IMPROVED TRENAIL FOR FASTENING RAILWAY CHAIRS.

This invention, recently patented by Mr. A Ransome, of Ipswich, has for its object improvements in the manufacture of and in fastening railway chairs with wood trenails. For these purposes wood trenails are made, compressed, and are allowed to cool or set in moulds or dies, in which they are compressed as heretofore; they then drilled longitudinally from the head towards the point, but the lower part or point is left solid in order to admit of its being driven into a sleeper without injury. It is preferred that the hole thus drilled into a wood trenail should be cylindrical, in order to its receiving a cylindrical metal spike, which should fit the interior of the hole closely without requiring any considerable force to drive it in, it being desirable that the spike should derive its principal holding by the expansion of the trenail after it has been driven. It is desirable that the wood trenails made with solid points or lower ends as above described should be driven by the aid of a tool with a hollow face (corresponding with the curvature of the upper surface of the head of the trenail), which is placed on the top of the trenail when it is being driven. This tool is made with a projection on its under side, which fits the upper part of the hole in the trenail. In using these trenails to fasten railway chairs to sleepers the trenails are driven in through the holes in the base of each chair into the sleepers, the spikes are then introduced into the hole formed in the trenails, so that when the trenails expand in use the spikes will be more and more securely held, and the chairs will be better fastened to the sleepers than when using metal spikes alone, or wood trenails alone.

Fig. 1 of the accompanying engravings shows a longitudinal section of a trenail constructed according to this invention. *a* is the wood trenail bored to a sufficient depth to receive the metal spike *b*, the lower part of the trenail being left solid.

Fig. 2 shows a longitudinal section of a wood trenail, and the method of driving the same into the sleeper before introducing the spike. *a* is the wood trenail; *c* is the tool having a hollow face corresponding with the curvature of the upper surface of the head of the trenail, and a projection *d* on its under side, which fits the upper part of the hole in the trenail.

RANSOME'S IMPROVED TRENAIL FOR FASTENING RAILWAY CHAIRS.

FIG. 1.

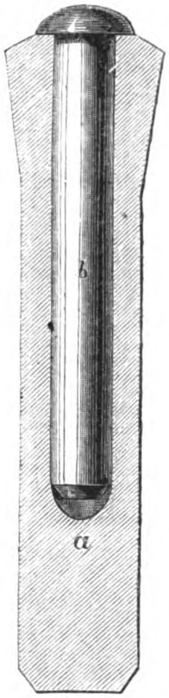
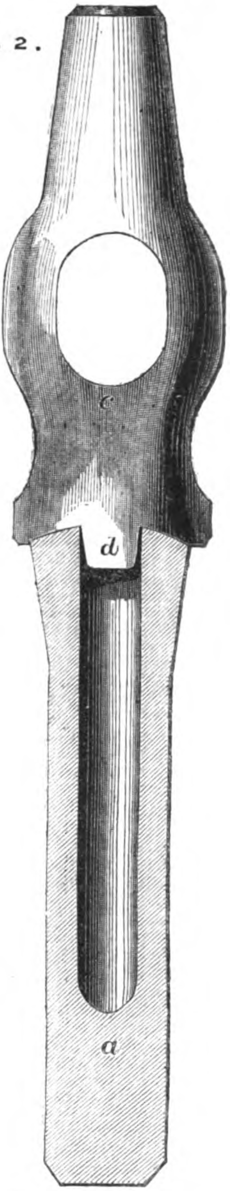


FIG. 2.



Messrs. Laird Brothers have just completed for Messrs. Cruse and Downham a new tug-vessel, called the "Columbus," fitted with a pair of their disconnecting diagonal engines, 90-horse power nominal. Speed being now a great object with tug-boats, as with all other ships, the "Columbus" was built to combine great speed with first-rate towing qualities, and on her first trial in smooth water she attained a speed of 14 knots, her engines indicating 7¼ times the nominal, or 650 effective horse-power. Her final trial took place on Thursday and Friday last, when she went to Holyhead and back. She accomplished the run, although she had considerable sea and wind to contend against, at an average rate of 12½ knots per hour, with a very moderate consumption of fuel. Messrs. Laird Brothers have built several vessels, and fitted them with engines of the same description as those on board the "Columbus." Some are at work in China, in Russia, and other parts of the world, and on the river Mersey. From their simplicity, these engines are kept in repair at a very moderate cost, and they are also very economical in fuel, and for these reasons they appear likely to be very generally adopted.—*Liverpool Daily Post.*

We are surprised not to see Mr. William Fairbairn's name amongst the newly baked batch of baronetcies. The honours of knighthood have been offered both to himself and to his son, and what is baronetcy but knighthood raised to the second power?

Meetings for the Week.

MON.—*Royal Inst.*, Special Meeting of Members, at 2 p.m.
London Inst., "On Sculpture," by R. Westmacott, Esq., R.A., at 7 p.m.

TUES.—*Inst. Civil Engineers*, "Discussion upon Mr. Preece's Paper on Railway Telegraphs, and the Application of Electricity to the Signalling and Working of Trains," at 8 p.m.
Royal Inst., "On Animal Mechanics," by Prof. Marshall, at 7 p.m.

WED.—*London Inst.*, Conversazione.
Soc. of Arts, "On Colonization and Convict Labour in the Hudson's Bay Territories," by A. K. Isbiter, M.A., at 8 p.m.

THUR.—*Royal Inst.*, "On Chemical Affinity," by Prof. Franklin, at 3 p.m.
Royal Soc., at 8.30 p.m.
Antiquaries, at 8.30 p.m.

FRI.—*London Inst.*, "On the Chemistry of the Non-Metallic Elements," by F. Field, Esq., at 7 p.m.
Royal Inst., "On Radiation through the Earth's Atmosphere," by Prof. Tyndall, F.R.S., at 8 p.m.
Architectural Assoc., "The Use of Libraries," by J. W. Papworth, A.I.B.A.

SAT.—*Royal Inst.*, "On Life and Death," by W. S. Savory, Esq., at 3 p.m.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to M. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 6 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of his good faith.

RECEIVED.—Capt. C. C., J. N., T. S. S., Captain R. J. B., J. W., W. H. S., R. R., Admiral F. G. H., J. P., N. P. E.

COSMOPOLITAN (Chelsea).—"On Guns and Projectiles," will appear next week.

F. A. P.—The only way to protect an invention is by taking out a patent. After you had obtained the provisional protection, your invention would be then pretty well secured for six months.

J. D.—The secretary of the Northern Institute of Mining Engineers, is Mr. John Daglish, of Hatton.

F. S. (Brighton).—Thanks for your letter of the 11th and the information therein contained.

J. Y. BETTS (Coventry).—Your plan of constructing "the engine, so that its forepart should be of a wedge shape, as also the hand part of the guard's van," would not prevent a collision, nor would it much diminish the shock. More damage is often done by a train being thrown off the line than by a collision.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our Correspondents.*]

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STRENGTH OF IRON AND STEEL.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—As you have deemed my former remarks on Mr. Kirkaldy's work worthy of publication in your scientific journal, I am emboldened to make others on the same subject. I observe, that in a discussion which took place in the Institution of Scottish Engineers, on the 29th October last, as reported in your issue for January 2nd, the members present appear to have been at a loss to understand the effect of frost on iron, viz., how it happens that iron is more brittle in frosty weather than in summer.

There has never appeared to me any difficulty in accounting for this. Iron melts at a certain temperature; it is easily hammered into any shape at a lower temperature when colder still; it yet retains a portion of its ductability, but is not, by any means, so readily worked. In short, the less heat is added to it, the less ductile and the more brittle does it become.

Herein is the whole simple explanation, why, in frosty weather, iron tires so readily snap. A brass or gun metal band ¼ or ⅛ in. smaller than the extreme size of the iron wheel might be put on. Reasoning by analogy, we would arrive at the conclusion, that there is a point of low temperature where iron would lose all cohesive force and crumble to pieces; and if iron, then why not everything else on this earth which becomes brittle by want of heat.

I am, &c.,
CHAS. BATHOE.

28, York-place, Portman-square,
Jan. 10, 1863.

REPAIRING THE "GREAT EASTERN."

SIR,—I noticed in your journal of Jan. 9th, a long account, extracted from the *Scientific American*, of the plan employed in repairing the damage done to the "Great Eastern," whilst afloat, and I also observe that it is termed an "extraordinary feat of hydraulic and mechanical engineering."

It may, perhaps, be interesting to the writer in the *Scientific American*, to know that this identical contrivance was described just 40 years ago, and if he will refer to vol. 40 of the "Transactions of the Society of Arts," he will find an engraving and description of it.

It was invented by a Mr. W. Hookey, to enable the under-water portions of a ship to be repaired whilst the vessel was afloat, and thus avoid the loss of time caused by docking. It is amusing to see the resuscitation of this plan after an unknown existence of 40 years.

I am, &c.,
CHAS. F. T. YOUNG, C.E.

7, Duke-street, Adelphi,
Jan. 10, 1863.

INTERNATIONAL AGRICULTURAL EXHIBITION AT HAMBURG.

SIR,—An International Agricultural Exhibition is to be opened at Hamburg on the 14th of July, 1863, for the space of one week.

The very accessible situation of Hamburg, both by land and sea, renders it a most convenient place for an exhibition of this nature, and it is hoped that English agriculturists and manufacturers of agricultural implements will heartily co-operate towards the success of the undertaking.

The committee are making exertions to induce all steam navigation and railroad companies to convey at reduced rates of freight live stock, machinery, agricultural implements, and produce, that may be destined for the Exhibition. Their endeavours have not yet terminated, but, so far, every encouragement to this end has been held out to them, and they will not fail to make generally known their arrangements as early as possible for the information of exhibitors.

The articles exhibited will be exempted from duties, and the usual Customs' regulations will, in their case, be suspended.

The committee have secured the hearty co-operation of the German Agricultural Society; they are liberally supported by the Hamburg authorities and other Governments; indeed, so many agricultural societies in different countries, especially the Royal Agricultural Society of Great Britain, have evinced such a warm interest in this the first undertaking of the kind in Germany, that the committee are encouraged to use their most strenuous efforts to render the Hamburg International Agricultural Meeting of 1863 memorable for its importance.

All prizes are open to general competition.

Applications must be made on or before the 1st of May, 1863, to the Secretary,

GERHARD HACHMAN, LL.D.,
Hamburgh.

Hanseatic Consulate General,
12, Austinfriars, London.

THE AUSTRIAN AND PRUSSIAN PATENT LAWS.

SIR,—Having read with great interest an article on "Patent Law Reform," that appeared in your Number for Jan. 2, perhaps the following observations on the working of the Austrian and Prussian patent laws may not be deemed inacceptable to your readers:—

The Austrian law of 1852 was framed by men possessing an intimate knowledge of the then state ot the empire, and who were desirous of prefacing the intended introduction, in 1860, of the freedom of trades and of labour. From 1852 to 1860, the law was of the very greatest benefit to the industry of the empire, from the facility of obtaining a patent, its extreme cheapness, and the fact of its rendering the holder free of the Guilds and of their heavy taxes. Since 1860 the number of patents granted yearly has increased, as trade and manufactures in Austria have, since 1860, also increased in an accelerated ratio.

On the other hand, the protection against piracy is still too slight, and, in most cases, a patentee prefers *not* to prosecute at all, rather than to risk the costs of an action in a province distant from the capital, or from that part of the country where he is himself residing. This arises, not so much from the *wording* of the law (which is very stringent as to putting down piracy, but, nevertheless, gives no damages unless the piracy be repeated), but from the fact of any piracy having to be judged by experts chosen by the court of law; which experts seldom understand the nature of the invention itself, and often decide more from local partiality, rather than according to the merits of the case. I repeat, the wording of the law and its effects upon industry have been excellent, but the law is carried out too laxly. The patents being granted at the risk and peril of the applicant, it often happens that inventions are patented over again. Again, medicines and edibles are stated as not patentable by law, yet medicine and food patented in other countries are advertised daily in the newspapers. It is true, however, that the College of Medicine brings frequent actions to stop such sales, and the vendors, very generally, have to pay a fine.

A very large number of the patents granted are worked out I should say, about 40 per cent., and of these, from 16 to 20 per cent., pay; in some cases very well.

Nearly 60 per cent. of the Austrian patents are for inventions connected with mechanics.

The Registration of Samples and Designs, which was instituted in Austria in 1858, affords, for the small charge of five florins, a protection for three years. This is merely for a novel design, pattern, or form, of something in general use, and the registration is made at another office, and is under another administration than that of the patent office itself, which is a branch of the Ministry of the Interior. It was, formerly, under the Ministry of Finance.

The following account of the working of the Prussian patent law was mainly translated from the letter of a valued correspondent in Berlin:—

I must first state, that no special law concerning patents exists in Prussia, but all patents are judged and determined according to a decree (Publicandum), dated Oct. 14, 1815, from Paris. This Publicandum, given below, is not even inserted in the collection of laws (gesetzsammlung).

The way of transacting the business is this:—A permanent committee of five members is entrusted with the examination of the invention. They are assisted in their work by reference to a first-rate library, and the use of every existing periodical on commerce, mechanics, and science.

The granting a patent depends upon the novelty of the invention, whether the principle itself (prinzip), the improvement, or even the arrangement, especially in the case of machines, be considered as new.

The committee lays before the Minister their opinion of the invention, which is, as a rule, accepted by the Minister, and carried out accordingly.

The committee acts with extreme caution; and, as they consider themselves, to a certain extent, answerable for their votes, no small invention, or minor improvement, ever obtains a patent. As no higher court of appeal exists, any applicant has to rest satisfied with the decision.

Foreigners, in particular, feel most severely this utter want of a proper law; they very naturally secure their inventions first in their own country; it happens, therefore, very often that the invention comes to the knowledge of the committee sooner than the application for a Prussian patent, either by means of periodicals, a description of foreign patents, or more particularly by the publications of the English Patent Office. And, as novelty in invention is the only thing which can be patented, it follows that a patent is at once refused, and without power of appeal.

My experience tells me that this defective state of the law, and which was not even suited to the last century, acts most deleteriously on our industry. No one will take the trouble to make or carry out inventions, unless they can look forward to some reward or profit; and if, notwithstanding this, there are still parties who apply for patents in Prussia, it is only those who have not as yet endured the annoyance of a refusal. Consequently, no one endeavours to make or carry out inventions or improvements, but, having one of importance, takes it to foreign countries. Very often I have heard foreigners say, that they would come to Prussia or Berlin itself, to establish themselves, as soon as the patent for their invention be granted. The patent being refused, the foreigner remained in his own country, where the rights of intellectual property are under better protection than in Prussia, which, notwithstanding, is considered the seat of intelligence, *par excellence.*

I am, &c.,

Vienna. EDWARD ALFRED PAGET.

N.B.—Prussian patents are only granted to resident members of the Guilds.

THE WATER-GLASS BAROMETER.

SIR,—This simple apparatus, which I have myself used for nine months, and which is described by Mr. Copland, in the *Times,* was invented upwards of two hundred years since! I have found it, in general, more correct than the barometer.

1. The water rises *higher* with *cold* winds than it does with those which are *warm.*

2. The water rises *higher,* and then falls *lower,* before *snow* than it does before *rain.*

3. The water rises for some days (but always for some time) before the *change* of the weather, whether for snow or rain.

4. If presently *falls* again, even before the rain or snow falls.

5. When the *rain* is likely to be of a long duration, and accompanied with *heavy gales,* the water will be very *low* in the tube, and will be *indented* or *concave.* This generally takes place *eight* hours previously.

6. When the water is *high* in the tube. I invariably find that if the *hand* laid on the top of the bulb does *not* cause the water in the tube to *descend,* that no change in the weather will follow for twelve hours or more.

N.B.—The changes in this water-glass barometer will be beneficially studied by invalids, and more especially by those afflicted with epilepsy, and other nervous disorders, which are always more prevalent with a low state of this barometer—*anti-periodic* medicines being called for when this is observed. My glass is graduated similar to Mr. Copland's, and is furnished, moreover, with a very small thermometer attached to a *float,* which rises and sinks with the water. I am, &c.,

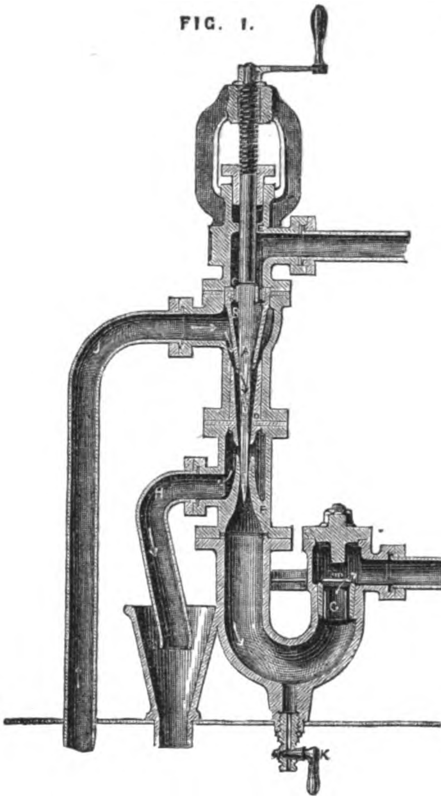
JAMES BRUCE.

1st January, 1863.

PS.—The following is a description of this weather-glass taken from a very old and scarce work:—"Procure at the glass-house a globular glass, with a tube or pipe thereto proportionable, whereof there are many sizes; but be sure let not the head be too big, nor the pipe too short, lest there be not rise enough in the winter, or fall enough in the summer. You must also have a small glass, or vessel, at the bottom, that may contain water enough to fill the tube, or more. Then, having fixed them in some frame made for that purpose, *heat the globe of the glass with a warm cloth, to rarify the air within it,* and then put the end of the tube into the lower vessel, and it will attract the water, more or less, as you warmed the head. You may also add numbers on the glass, to shew you the degrees. The water you may colour blue, with Roman vitriol boiled, or red, with dried rose leaves, and imbibed in fair water, wherein a little oil of vitriol, or spirit of salt, is dropped. With this water fill the under vessel, which, being rightly placed on the *north* side of your house, where the sun rarely, or never, shines against it, and in a room without any fire in it, lest the sudden access of heat, or accidental alteration of the air, might impede your observations. The air included within the globe, or ball, of this glass doth admit of dilation and contraction equally with the ambient air, that whensoever the ambient air is dilated or expanded, either through the heat of the season, or before the fall of rain, &c. The air in the glass is the same, and as, by its expansion, it requires more room, so doth it let the water in the tube descend gradually; or, as it is more dense or contracted, either through the coldness of the season, or the serenity or inclinability to draught of the ambient air, so also doth the air within the glass contract itself in a less compass, and sucketh up the water in the tube gradually, as it condenseth or contracteth; whence you may at any time know the very degree of rarity or density of the ambient air, by that which is included in the glass, and thereby inform yourself what weather is most likely to suceeed at any time. Be sure to quadrate or contemporise your observations or numbers of degrees with the season of the year; for that degree of rarity which signifies rain in the winter, may be such a degree of density that may signify fair weather in the summer. The differences betwixt the highest rise and the lowest fall in one day in the summer, is much more than in the winter; for you shall have a cold night and very serene air, which contracteth the air in the glass into a small space. after which usually succeeds a very hot day, which dilateth it very much; when in the winter no such great difference happens in one day. Yet in the winter, in several days, will the difference be as great as in several summer days. Although the air appears serene and cold to your senses, yet trust not to that, if the glass signify otherwise."

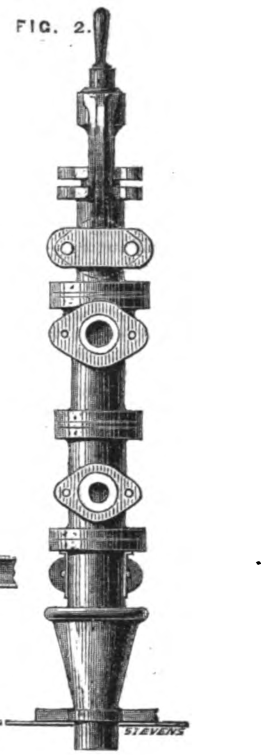
PRADEL'S IMPROVED INJECTOR.

FIG. 1.



SECTION.

FIG. 2.



END VIEW.

AN IMPROVED INJECTOR.

THE accompanying engravings show a modification of that remarkable feed apparatus, the Giffard injector. This plan has been introduced on to the injectors used on the Lyons Railway, France, by Monsieur Pradel, the "Sous-chef de traction" of that line. The engravings show to one-twelfth scale, an injector intended to feed 120 litres of water per minute. The steam entering by the pipe *b*, circulates round the cone *a*, whence it issues in the shape of a circular jet into the chamber *d*. The steam, by its motion, carries with it the air contained in the pipe *j*, and consequently draws up the water, which, surrounding the cone *b*, condenses the steam on its arrival. The water then passes successively through the chamber *d*, and through *f*, and lifting up the clack valve *g*, the water enters the boiler. The pipe *h* is for receiving the condensed water formed on starting or stopping the apparatus.

Gossip.

M. Regnault has described a method of recording the temperature and pressure in balloon ascents, without observation of the aëronaut. The apparatus consists of a series of tubular reservoirs, with capillary tubes proceeding from them; at the end of each capillary tube a larger tube, filled with chloride of calcium, is fixed, so that only dry air can enter the reservoir. These constitute the thermometric system. The barometric consists of a similar series, with their reservoirs immersed in melting ice. In order to insure the temperature of the ice remaining constant in the extreme cold of the upper regions, it is recommended to surround the vessel containing the ice with another vessel containing warm water at starting. The tubes are numbered to correspond in each series. To determine the temperature and pressure at any moment, it is necessary to close the stop-cocks of one tube in each series simultaneously, the balloon not being in rapid motion at the time. The density of the air contained in the tubes is afterwards determined, from which both the temperature and pressure at the time of closing can be deduced.—*Popular Science Review.*

At the last November meeting of the Franklin Institute, Philadelphia, Mr. Howson exhibited a family Bible, in which, adjacent to the pages usually bound in the book for the registration of births, deaths, &c., were arranged in sheets any convenient number of card cases, such as contain the ordinary photographic albums, and in which could be inserted the photographs of the different members of the family.

Several French papers assert that the French Emperor is bringing out an electro-magnetic engine. It is being made at a well-known Parisian engine builders' shop, and sanguine hopes are entertained that it "will give out a double or treble force to that of the steam-engine." We suspect that Napoleon will find that it is easier to upset a republic, or uphold a Pope, than to dethrone King Steam.

The cotton wads with which engineers clean their machinery are afterwards worked up into some descriptions of shoddy. Cotton waste, often used for the same purpose, is manufactured into writing and printing paper; whilst in America it is made into an imitation of papier maché.

Louis Gover, 40, electro-plater, was indicted for feloniously having in his possession certain instruments for the manufacture of counterfeit coin.—Brennan, inspecting officer to the Mint, went, accompanied by several police officers, to the residence of the prisoner in a retired place known as Leslie's-gardens, Bermondsey. The house consisted of three rooms, one above another, and on Brennan reaching the top room he found two galvanic batteries properly charged with acids, ladles with white metals recently fused, files, plaster of Paris, antimony, sand, and all the usual implements used by the makers of counterfeit coin.—The jury found the prisoner guilty, but the Common Serjeant deferred passing sentence, in order that the opinion of the Court for Crown Cases Reserved might be taken as to whether the galvanic batteries found on the prisoner's premises came within the definition of the 24th section of the 24th and 25th Victoria, viz., "a machine" for the making of counterfeit coin.—Sentence was accordingly deferred.

On Wednesday week the last rivet in the Londonderry Iron-bridge, was secured by the chairman of the bridge commissioners, assisted by Mr. John Hughes, C.E., resident-engineer, and Mr. Matthew Pitts, representative of the contractors. This bridge is 4,200 ft. long, and has been twelve months in erection. Messrs. Butler, of Stanningley, were the contractors.

An extensive series of experiments is about to be made in France with the typo-telegraph invented by M. Bonelli, by which 500 despatches, of 25 words each, can be printed within an hour. Should the experiments prove satisfactory, it is intended to introduce this telegraph on the principal railway lines in France.

Among the many new companies that the plethoric state of the money market is creating, one of a most novel and curious nature is talked of. The object is to construct a gigantic reflecting telescope, of far greater dimensions than Lord Rosse's celebrated 6 ft. reflector, with which it is expected wonderful planetary sights will be revealed.

Mr. Robert Aytoun, the inventor of a well-known safety-cage for miners, has proposed a new safety-break for railway trains to the Scottish Society of Arts. He suggests to fix to the sleepers, between the rails, a longitudinal strip of timber, 5 in. square, to be compressed by a pair of compound bladed springs, of any requisite amount of power affixed beneath the break-van, and under the command of the guard. This would be rather an expensive plan for a long line of railway.

A phenomenon, observed within the last few days at Varages (Varr), would seem to indicate that the recent sudden changes in the weather in the south of France have been accompanied by some disturbances below the surface of the earth. A fine spring, which from time immemorial had supplied the above-named village with water, last week suddenly poured fourth a stream of water entirely black and extremely nauseous. This continued for three days, when the water began to clear, and is now as limpid and as sweet as ever.

The mill-owners in England, generally, have ordered their mill-girls to leave crinoline outside the walls. It is said that gentlewomen lose their lives at the rate of 750 per annum through their skirts catching fire. If the ladies will not render their dresses fire-proof by means of chemistry, why don't they take to mechanics, and "box off" the fire with wire guards?

In the Geological Museum there is a lump of silver—about as much as would make 40s.—which has been taken from the stomach of a mule in Mexico. It appears to be a common occurrence to find quantities of silver in the the stomach and intestines of the mules working in the Mexican silver mines, and its presence is accounted for by the mules eating mud, which contains much silver, for the purpose of obtaining the salt which is mixed up with it also. The silver is said to accumulate to a considerable extent without proving injurious.

Of oakum made from old ropes, Mr. Simmonds states that 1,400 tons, valued at £28,000, are sold annually in Liverpool. The total imports of codilla or tow (the waste fibres which occur in the cleansing of hemp and flax), amounted in 1857 to 13,000 tons, valued at £373,000. It is manufactured into bags, yarn, &c.

A gun built entirely of steel, and composed of several tubes of that metal, put together in the method introduced in France by Colonel Trenillee de Beaulieu, but better known in England as "Blakeley's" plan, and which secures the simultaneous action of all the tubes in resisting the bursting force of the powder, has been recently tried in that country. The gun weighs only 4¾ tons and a few pounds, or nearly 3 tons less than the Armstrong gun rifled on the Whitworth plan. The French gun is rifled with three grooves, less than a quarter of an inch deep. The twist of the rifling is uniform, one turn in 30 calibres, being a slightly quicker turn than that used by Armstrong, and a little slower than that used by Cavalli and Whitworth. The gun, when last heard of, had been fired 800 times without injury. The shell weighs 45 kilogrammes or between 99 lb. and 100 lb. The service charge of powder is 12½ kilogrammes, or about 28 lb., although in some cases 15 kilogrammes, or 33 lb. of powder, were fired. With reference to the question of the introduction of flat-headed projectiles, it is scarcely perhaps necessary to mention that they were first brought into public notice by Captain Norton in 1852, and were described by him as "punch-headed iron shells." The gallant captain, with more modesty than other inventors, did not, however, claim for his shell the advantage of novelty, but only the method of rendering it applicable to modern artillery. The Austrians are said to be using for their cannon an alloy called Aich metal, from the name of the inventor, and composed of copper 600 parts, zinc 382 parts, and iron 18 parts. Its tenacity and toughness are said to be very great.

The trade in petroleum or American rock oil continues to increase with extraordinary rapidity, and promises to become of so much profit and importance to the country as to render it essential that the commercial public should not allow the business in it to be needlessly restricted by vague alarm as to danger attending its storage. According to a circular of Mr. Macrae, a Liverpool dealer, although the American oil was almost unknown in 1860, a total of 9,000,000 gallons was imported into Europe in 1862, and not one disaster happened in connexion either with its transit or storage which would not equally have occurred to any other article of production. Recent advices from Belgium assert that the Minister of the Interior has just taken occasion expressly to declare that this oil is not to be considered as one of the articles of inflammable merchandise which must be treated by special regulations as essentially dangerous.

A Trieste letter in the *Frankfurter Journal* says:—"The first merchant steam vessel built here has just been completed. It measures 1,000 tons, and has been constructed by M. Tonello, who has the intention of building five others still larger, and competing with the English line of steamers between Liverpool and Trieste. M. Tonello affirms that there are few maritime places in Europe where the construction ot vessels can be carried on at less expense than at Trieste."

M. Brachet has proposed as an improvement, in applying the electric light, to inclose the light within a globe of uranium glass, and that again within a second glass globe, of such a colour as to correct the greenish tone of the resulting light: and the proposal has been referred to MM. Regnault and Babinet for consideration.

ALUMINIUM BRONZE.—In the supplementary number to vol. 24 of the *Philosophical Magazine*, just published, we find a remarkable article, by Lieutenant-Colonel A. Strange, F.R.A.S., on the properties and present value of aluminium bronze, an alloy consisting of ten parts of aluminium and 90 of copper. Its tensile strength is stated at 73,185 lb. per square inch, being more than double the breaking strain of gun-metal, and 1,185 lb. more than the avarage tenacity of cast steel. Its resistance to compression is 132,416 lb. to the square inch; that of cast iron being 115,542 lb. As to malleability, this alloy may be drawn out under the hammer almost to a needle point at a red heat. Its rigidity is about three times that of gun-metal, and 44 times that of brass; it is less affected by change of temperature than either of the latter; it may be cast with extraordinary facility into any shape; it does not clog the file, and yields fine elastic shavings on the lathe. It tarnishes much less readily in the air than any other metal or alloy used for astronomical instruments, and will receive the finest graduation possible. It is extremely elastic, can be rolled into sheet metal, or also hammered and drawn, and seems admirably adapted for the tubular parts of astronomical instruments. Its specific gravity is 7·689, nearly the same as wrought iron. To make this alloy extremely pure copper should be used; the best is copper deposited by electricity; but, since that kind is very expensive, the next best is copper from Lake Superior, which makes an alloy of an excellent quality. The ordinary coppers of commerce generally fail, owing, it is said, chiefly to the presence of iron, which appears to be specially prejudicial. Another precaution is to remelt the alloy two or three times. The first melting, in the proportions above stated, produces an alloy of extreme brittleness; but each successive melting, up to a certain point determined by the working, and particularly the forging properties of the metal, improves its tenacity and strength. The present price of English made, 10 per cent. Aluminium bronze is 6s. 6d. per lb., or four or five times the price of gun metal; but as a much smaller quantity of the new alloy would give the same strength, the cost of ordnance made of it would not be very considerably increased.—*Galignani's Messenger.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 1789.
BOILERS AND FURNACES, 1769, 1779, 1805.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 1809, 1795.
SHIPS AND BOATS, including their fittings, 1782.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 1784, 1788, 1793, 1799.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 1765.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1772, 1781, 1797, 1806, 1808.
BUILDINGS AND BUILDING MATERIALS—*none.*
LIGHTING, HEATING, AND VENTILATING, 1774, 1777, 1783, 1785.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1768, 1771, 1775, 1791, 1794, 1804.
METALS, including apparatus for their manufacture, 1767, 1787, 1790.
CHEMISTRY AND PHOTOGRAPHY—*none.*
ELECTRICAL APPARATUS, 1778, 1801.
WARFARE, 1763, 1764, 1792, 1796, 1798, 1807.
LETTER-PRESS PRINTING—*none.*
MISCELLANEOUS, 1766, 1770, 1773, 1776, 1780, 1786, 1800, 1802, 1803.

1763. W. E. NEWTON. *Improvements in firearms, and in the attachment of bayonets or swords thereto.* (A communication.) Dated June 13, 1862.

This relates, 1, to breech-loading firearms, and consists in effecting the connection of a moveable breech, which opens and closes by an upward and downward swinging movement on a pin passing transversely through the arm, with a lever mounted under the stock by means of two pins, one of which is attached rigidly to the bottom of the breech, and is arranged lengthwise of the arm. A sliding collar is also applied on the first pin, and is pressed forward against the second one by a spring placed in rear of it, such spring holding the breech open after it has been opened by the movement of the lever, and while the arm is being loaded. The second part of the invention relates to the mode of applying and operating a device for withdrawing the discharged cartridge cases in a rearward direction from the barrel of the firearm. The third part of the invention consists in applying the hammer, the tumbler, and the spindle or arbor to which they are attached in the metal frame of the stock of a firearm, whereby the lock is enabled to be made very strong without cutting away and weakening the stock to such an extent as is done in many firearms. The fourth part of the invention consists in the attachment of a bayonet or sword to a firearm by means of a pivot joint, which permits it to be brought from the position known as "fixed" to a position close under the stock. *Patent completed.*

1764. W. E. NEWTON. *An improvement in elongated bullets.* (A communication.) Dated June 13, 1862.

This consists in the combination with an elongated expanding bullet of a headed pin, and a concave expanding disc, the disc having its concave side against the base of the bullet, and the pin entering the cavity thereof, and operating to produce the flattening of the disc, by which the latter is caused to expand against the walls of, and enter the rifle grooves of, the gun, for the purpose of preventing windage, and obtaining for the bullet a rotary motion on its axis. Also in making the pin and the cavity of the bullet of a conical form, in order to reproduce the expansion of the cylindrical portion of the exterior thereof at the forward part. By making the front end of the pin conical, the cylindrical portion of the bullet will be first expanded, thus causing the friction against the bore of the gun to begin as far forward as the bullet shall bear against the bore, by which the bullet will be more quickly and perfectly upset, its friction will be more easily distributed, and its centre of gravity made more evenly to coincide with the centre of the bore of the gun, all of which conditions are necessary to accurate shooting. *Patent completed.*

1765. J. IVES. *Improved apparatus for expressing juice from fruit and other vegetable substances.* Dated June 13, 1862.

This consists principally in the use of elastic rollers for crushing the fruit, &c., and expressing the juice. *Patent abandoned.*

1766. J. ROBINSON. *Improvements in machinery or apparatus for sawing wood.* Dated June 13, 1862.

This relates to machines called timber and deal frames, and consists in so constructing and arranging them as to cause the whole of the feed to take place during the upward motion of the same. *Patent completed.*

1767. J. LANCELOTT. *Improvements in the manufacture of ornamental chains from sheet metal.* Dated June 14, 1862.

This relates to the forming of chains from punched blanks of peculiar construction, each link being formed of two separate blanks of different form, which blanks are afterwards soldered together and so united. The invention is not described apart from the drawings. *Patent completed.*

1768. T. Williams and H. Cox. *Improvements in churns, partly applicable to washing machines.* Dated June 14, 1862.

Here the patentees provide the lower part of the case or body of the churn with a chamber or chambers distinct from the interior of the churn, the said chamber or chambers having an opening or openings communicating therewith, so as to admit of cold or hot water or liquid being poured therein; an orifice with plug for stopping the same as is used for drawing off this water or liquid. To withdraw the milk there is an orifice as at present sometimes used in churns at or near the bottom, the same being stopped by a plug when not used for drawing off, the butter being taken out from the top. In the interior of the churn they use beaters adapted thereto, which they prefer to set slantwise, so as to churn with greater effect. These beaters are framed together, and they prefer to secure the same to the base by pivots, one of these pivots passing through a stuffing box, the same being an axle pivot, and having attached thereto special arrangements for working the beaters. *Patent completed.*

1769. J. Sawyer and G. Padgham. *Improvements in steam boiler and other furnaces, applicable in part to grates of various kinds.* Dated June 14, 1862.

An important feature in this invention is the use of firebars each of which is curved in the upper as well as the under surface thereof, each of such bars having projections at each side, so that when one bar is put in position by the side of another, these projections may fit or nearly fit against each other, leaving openings between them, producing in effect a number of air tubes or passages, admitting the air to the fuel in the furnace to assist in the more effectual combustion of the said fuel. The invention also comprises improvements in the fire-bridge and furnace door. *Patent completed.*

1770. J. G. A. Dallot. *A new portable circular saw.* Dated June 14, 1862.

This saw is mounted on points, as also the shaft of the saw and the fly-wheel, and by this means less power is required than if mounted on bearings. The points may be made either on the shaft or on the screws on which turns the shaft of the saw. Motion is communicated by a crank to a toothed wheel, thence to a second wheel, which communicates it to a fly-wheel placed on the saw shaft. This is the method the inventor prefers, but the fly-wheel may be placed on the driving shaft, and the driving gear be more or less complicated. This description of saw is set on a frame or table, the toothed gearing on the side at one end, and the fly-wheel on the side in the centre, and commanding the saw which is in the centre of the table, and placed so as to present nearly half its diameter above the level of the table. On the top of the table is an iron or wooden regulator for directing the wood, so as to give the size desired. The top of the table is moveable, and is raised either at one end by a screw, or horizontally by screws, with rag chain, or otherwise. The lifting of the table top or board gives the facility of making rebates, grooves, tenons, and similar work. Saws may also be constructed on this method with two cranks, rag wheel, and chain-driving band or toothed gearing. *Patent abandoned.*

1771. J. F. Miguel. *An improved pessary.* Dated June 14, 1862.

This is composed of caoutchouc, or other elastic material; it is oblong, and varies in lenth from 2 in. to 5 in.; it is longer in the middle than at its ends, which are cut straight, their edges, and all the edges of the pessary, being rounded; the thickness also varies between about ¼ in. and 1 in. The centre of the pessary is pierced with an elliptic hole, varying in diameter according to the state of the parts which it is to lift and fix, and each extremity is furnished with a handle of strong silken thread, varying from 7 in. to 8 in. in length. This retentive apparatus is introduced by one of its extremities into the vagina towards one of the sides, and the other is pushed against the opposite side, so that it rests in front of the ischunin. There are other details. *Patent abandoned.*

1772. J. H. Johnson. *Improvements in Jacquard machines.* (A communication.) Dated June 14, 1862.

This relates to a peculiar construction and arrangement of certain parts of Jacquard machines, and to a mode of operating the same, whereby a considerable economy in the number of cards is effected by causing each card to serve four strokes of the cylinder or prism, in lieu of only one. According to this invention, the prism, or cylinder, is so built up or constructed as to admit of that portion which carries the card pins or studs being slid laterally by a rod or spindle acted upon by an eccentric or otherwise, and inserted into one end of the cylinder, suitable springs being used inside the cylinder for returning the pins to their places again when the action of the rod ceases. The surfaces of the cylinder, or prism, are provided with a series of grooves, or channels, made transversely across each face, in substitution for the perforations hitherto used. The cards have each four different sets of holes punched therein, and, after the first stroke of the cylinder, the ends of the needles are slightly elevated, so as to bring them opposite a second set of perforations for the second stroke. Previous to the third stroke, the card is moved longitudinally along the cylinder, or prism, as before stated, which has the effect of bringing the third set of perforations opposite the needles, and the fourth set of perforations are brought into action by lowering the needles again to their original position before making the last stroke, after which the cylinder is rotated one quarter turn, so as to bring a fresh card into action. *Patent abandoned.*

1773. W. Bouch. *Improvements in cranes.* Dated June 14, 1862.

This invention applies chiefly to those machines known as "accident cranes," and which are fixed on trucks for use on railways. This invention consists in constructing cranes as hereafter stated:—The patentee connects the inner end of the jib to an axis, on which it is free to be moved, to alter its inclination, without altering the angle of the castor wheel. He attaches to the top, or outer end of the jib, by universal joints, two legs, one on each side of the jib. When the crane is out of use, these legs are laid and carried horizontally; but when the crane is required for lifting or pulling heavy weights, they are brought to the ground, and afford support to the jib. He connects swinging bars and carrying bars to the rear of the crane, and fits to the latter, by means of rollers, or wheels, a counterbalance weight, the position of which is adjusted so as to bring it nearer or farther from the crane on the carrying bars, by means of a chain coiled upon a barrel, and worked by a worm and wheel. When the counter-balance is not required, it, together with the swinging and carrying bars, are drawn up into a vertical position. He attaches two short legs by universal joints, similar to those at the outer end of the jib, which are placed on each side of the truck, or vehicle, carrying the crane; these are to be used for affording support to the crane when lifting from the side. He also applies similar legs to each end of the crane, carriage, or truck, to prevent its moving when the crane is lifting or pulling from either end. *Patent completed.*

1774. R. A. Brooman. *Improvements in coking ovens in collecting and utilizing the products resulting from the distillation or carbonization of coal and other matters producing coke, and in apparatus employed therein.* (A communication.) Dated June 14, 1862.

This invention consists in the construction, arrangement, and working of coking ovens in manner hereafter described, whereby the following products are obtained during the manufacture of coke:—1, Coke suitable for metallurgical, railway, and other purposes, in greater proportion than when manufactured in the ordinary manner. 2, Gas suitable for burning and heating. 3, Tar, and different oils obtainable from it; and, 4, Ammonia and ammoniacal salts. The apparatus about to be described is not only applicable to ordinary coal, but also to anthracite, coke dust, peat, wood, and other combustible materials of vegetable or mineral origin, whether treated separately or mixed with rich coal, resins, or tars. Nine chief features are comprised in this invention. They consist, 1, In particular arrangements of carbonizing or coking ovens, capable of manufacturing coke from all kinds of coal. 2, In the application to these ovens of a continuous exhaust or draft for drawing off and collecting all volatile products resulting from the distillation of combustible matters. 3, In a method of condensing such of those products as are capable of being liquified, and in the proservation of each of such products, so as to utilize them. 4, In the application of gas produced in the ovens, whether to the heating of the furnaces of the coking ovens themselves or of other furnaces, or to the reduction of oxydized ores, or to any other purposes for which carburetted hydrogen can be employed, especially for lighting purposes. 5, In pulverising certain coals which would otherwise produce coke of a bad appearance, and ill adapted for metallurgical and railway purposes, whereas after pulverization of the coal, coke suitable for locomotives and other uses may be produced, and that without washing being necessary. 6, In mixing rich coal, tar, or resin, with poor coal, anthracite, coke-dust, peat, and other combustible materials, which do not by themselves produce good coke. 7, In the employment of steam thrown on the coke when at its highest temperature for desulphurizing it. 8, In the employment of apparatus, as hereafter described, for loading the apparatus with coal, and for removing the coke, whereby these operations are effected much more speedily and economically than in the ordinary manner. 9, In producing, in the same ovens as those used for the manufacture of coke, common tar, such as that obtained from gas works or other tars richer in oils, and in utilizing them in various ways.—*Patent completed.*

1775. W. Wighton. *Improvements in apparatus for regulating watches and other time keepers.* Dated June 14, 1862.

In carrying out this invention, the patentee attaches by arms to the ordinary regulator hand, a toothed quadrant, and causes a worm on a spindle to gear into the teeth of the quadrant. The spindle carries also a click or ratchet wheel for dividing the shifts, into the teeth of which a spring is made to drop at each shift with an audible click; the spindle terminates on the outer end in a square, and is moved by an ordinary watch key or other suitable instrument. He prefers that the teeth on the quadrant should be similar to those on a worm wheel. *Patent completed.*

1776. R. Hicks. *Improvements in the manufacture or preparation of paints, pigments, and colours.* Dated June 14, 1862.

The object here is for the useful employment of the debris or debritus obtained in slate quarries or slate works, in combination with any one of the known carbons or charcoals, such as lamp black, and such like matters, or of any of the substances containing sufficient carbon. These ingredients or schists or schistose substances, with the addition sometimes of oxide of iron or hematite iron ore, are intimately mixed together and subjected to the action of heat, whereby their chemical constitution becomes modified, so that when subsequently pulverized, they may be advantageously used as a paint, pigment, or colour. *Patent completed.*

1777. C. E. Courtillier. *Improved inhaling and saturating apparatus.* Dated June 16, 1862.

This consists in apparatus intended for inhaling vapour charged with medicinal substances; its utility is peculiarly conspicuous for the treatment of pneumonic diseases. It may also be of use as a purger of foul air in rooms. The apparatus consists of two recipients, which communicate together by an india-rubber pipe, supported by joining metallic tubes, and supported with cocks, the purpose of which, is to regulate or close any communication between both the receivers. The former, which the inventor calls a "generator," is placed above the flame of a spirit lamp, or upon any blaze or fire, and contains the water or medicated liquor to be vaporized; the steam passing through the india-rubber pipe gets into the latter, which he calls a "saturator;" it is of glass or metal, or any ceramic matters, and contains the medicinal mixture through which the steam devolves. On coming out of the medicated liquid, the vapour is sucked up into another india-rubber pipe or shank, tipped with a mouth-piece, allowing the sick person to inhale the steam saturated with medicinal principles. To the joining tube rising from the generator is adapted a small valve, which opens inwards to allow a small quantity of air to be introduced at every aspiration into the tube, in order thereby to facilitate the absorption into the stomach. *Patent abandoned.*

1778. T. M. Lanoa. *A geodetic and topographic instrument called Diastasimetre, intended to replace every one used in surveying.* Dated June 16, 1862.

The object of this invention is to combine in one all the instruments now used in surveying, and the instrument may be used for measuring distances from the shortest up to 500 yards or more, according to the power of the glasses or telescopes, for registering (with double register by rotation of the instrument or inversion of the glasses), for measuring inclines, and also for measuring horizontal angles, becoming in one moment, and without being dismounted, a graphometer and telescopic ring or circle. The improved instrument is composed of two glasses or telescopes—one fixed, the other moveable—a level, with air bubble and face at top and side, a graduated ring or circle, an alidade or cross staff set perpendicularly to the moveable telescope, adjusting apparatus to advance or retire the telescopes, adjusting screw for inclining the instrument, vice, and adjusting screw for advancing or retiring, and fixing the alidate, a socket supporting the instrument, the lower part of a rotula which permits the horizontal rotary motion being immediately above it, a screw serving to set the two parts of the horizontal movement, and a thumb nut to retain the instrument in a horizontal position. The instrument, which may rest upon a foot with three or six branches, possesses three distinct movements, namely, inclination backwards or forwards, right and left, until perpendicular, and horizontal rotation on its socket. *Patent abandoned.*

1779. J. F. Allan. *Improved furnace arrangements to prevent smoke and economise fuel.* Dated June 16, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1780. G. A. Birkbeck. *Improvements in the construction of presses for extracting liquids from various substances.* (A communication.) Dated June 16, 1862.

For the purposes of this invention, the body of the press in which the substances to be pressed are placed, is so constructed, that the use of bags or strainers may be dispensed with. This part of the press is of cylindrical, or other suitable form, with perforated sides enclosed by a strong ribbed frame, and closed by a moveable bottom, which, during the operation of pressing, is fixed in position, and, being also perforated, allows the liquid to pass away as the pressure is applied. The perforated bottom is, by preference, supported by a plate with channels to conduct the liquid to a central orifice. When the pressure of the piston is released, the moveable bottom can be readily withdrawn sideways by means of a screw lever, or other mechanical means, and the rake or residue of the pressed substance can then be readily discharged from the bottom of the press on to a platform, or into a suitable receptacle or carriage placed below to receive and remove it, thus saving considerable time in this operation. *Patent abandoned.*

1781. J. Evans. *Improvements in self-acting mules.* Dated June 16, 1862.

In carrying out this invention, the inventor, 1, Turns the twist shaft by means of a vertical shaft and pair of bevel wheels and catch or coupling box, instead of the driver, or counter straps at present employed. 2, He gives positive motion to the centre shaft by fixing on the end of the twist shaft a spur wheel gearing into a spur wheel on a horizontal shaft, which carries a bevel wheel gearing into a bevel wheel on the centre shaft. The wheel on the horizontal shaft traverses to and fro with the mule carriage, and gives the required revolution of the spindles with greater certainty than the ordinary grooved pulleys and rim bands. *Patent abandoned.*

1782. W. J. Curtis. *An improvement in the construction of screw propellers.* Dated June 16, 1862.

The patentee claims so constructing screw propellers that they will admit of being mounted in such a position on their driving shafts that the centre of gravity of the screw propeller will always be in a line drawn through the centre of the pintles of the rudder, the screw propeller being at the same time free to swing on its shaft at the option of the steersman. *Patent completed.*

1783. H. Bright. *Improved apparatus or arrangements for screening fires in stoves and grates, with the view to avoid accidents.* Dated June 16, 1862.

This screen or screening apparatus is to be made either of wire or open work, and caused to wind upon a roller attached to the top of the stove or fire-place, or to the sides thereof. Or it may be attached to the fender, to the mantel, or to the wall near the same. Or it may be made in parts, hinged or looped together, so as to fold up and be kept against the sides, the bottom, or top of the stoves, grates, or fire-places. Or it may be pushed up together like a bundle of rods, be drawn together like Venetian blinds, or expanded or contracted in any other manner, or drawn forwards, pushed back, upwards, or downwards, so long as, when not in use, it can be packed away clear of the fire, and yet, when required, can be drawn over the fire, screening or guarding the same to prevent accident. *Patent abandoned.*

1784. J. E. Holmes. *Improved machinery for digging or cultivating land.* (A communication). Dated June 17, 1862.

This invention relates to that description of machinery in which the land is operated upon by means of digging instruments, which act somewhat in the manner of spades. These instruments, which the inventor calls spades, are secured to shoulder-pieces or blocks, which support and strengthen them from behind. These blocks or shoulder pieces are fixed to wheels, which are mounted on a crank part of the axle-tree of the running-wheel or wheels whi rotate or roll over the surface of the land as the machine is drawn forward. To the peripheries of these latter are secured straight bars, which extend across the machine, and act as scrapers for the spade. As the machine progresses over the land, these spades are thrust out between the bars, and made to enter the earth, and dig or lift up a portion thereof, which, when the spades are drawn back within the peripheries of the large wheels, will be forced or scraped off by the scraper bars. Motion is communicated from the piston-rod of the engine to the crank-shaft, on which is mounted a pinion that gears into, and drives an intermediate wheel, whereby a large toothed-wheel secured to the arms of the running-wheels is driven. When it is desired to prevent the spades from working or entering the ground, the cranked part of the axle-tree is moved round part of a revolution, and the spade-wheels will then be lifted up. This movement is effected by causing a dog or trip lever to enter between the teeth of the large toothed-wheels, and be driven or carried forward thereby. This dog or trip lever is under the control of the engineer, who, by means of a lever and connecting rod, can easily throw it in or out of gear. *Patent abandoned.*

1785. S. H. Huntley, *Improvements in the construction of furnaces for effecting the more perfect combustion of fuel.* Dated June 17, 1862.

This invention consists in constructing inside the fire-box, or in the place over the fire-grate, of furnaces, air flues, or passages formed in fire-clay, or any other suitable material, and provided with perforations, holes, or slits, through which atmospheric air is caused to pass, and to impinge in small jets on to the top of the fire, by which a more perfect combustion of the fuel is effected.—*Patent completed.*

1786. A. Crestadora. *An improved mode of utilizing a certain well-known agent as a power to drive machinery, or to perform other work.* Dated June 17, 1862.

According to this invention the patentee obtains motive power from rarified air, and from aeriform fluids, by taking advantage of the two vital functions which are essential to the existence of combustion—the inhaling function and the exhaling function. As to the first, the improvement is based upon the chemical fact that the supply of a certain quantity of atmospheric air is necessary to effect and to carry on combustion; he therefore utilizes the atmospheric pressure consequent on the partial vacuum which is formed by what may be called the air-sucking property, by applying such pressure to the purpose of driving machinery, or of performing such other work as may be performed by the motive power thus obtained. As to the other vital function of fire, the exhaling action which is exerted through the chimney, he utilizes it by transferring to the chimney-shaft the apparatus and arrangements (described in the specification) applied to the pipe which leads to the ash-pit. *Patent completed.*

1787. J. Hunt. *An improvement or improvements in bronzing or colouring articles of copper or alloys of copper.* Dated June 17, 1862.

This invention consists in treating articles of copper or alloys of copper with a solution of bichromate of platinum, whereby a film or coating of metallic platinum is deposited on the article, and its surface thereby bronzed or coloured of a bright steel colour, or of a grey colour, the depth and character of the colour depending on the state of the surface of the article treated. If the article has been burnished previously to being treated with the solution of bichloride of platinum, it assumes a blue or dark steel tint, which varies with the length of time it is immersed, and the strength and temperature of the solution. The patentee prefers to use a weak solution of bichloride of platinum, and to heat it to the boiling point, but he does not limit himself to any particular temperature, as a cold solution may be employed with good effect. *Patent completed.*

1788. W. Sinnock. *Improvements in the manufacture of compound fabrics, and in the arrangement of apparatus for manufacturing same.* Dated June 17, 1862.

Provisional protection has not been allowed for this invention.

1789. A. W. Makinson. *Improvements in locomotive and stationary engines.* Dated June 17, 1862.

The object of this invention is to lessen the liability of the driving-wheels of locomotive engines, or of the paddle-wheels of steam-boats, to slip. This is effected by reducing the maximum rotative power, as it is termed, of the steam, without reducing the power of the steam to produce in the locomotive or the steam-boat progressive motion, so that an engine to which this invention is applied, when compared with an ordinary engine of the same power, will not make the same demand upon the adhesion at the rail in the case of the locomotive, or upon the resistance of the water in the case of the steam-boat, and, consequently, in the former case, the load upon the driving-wheels may be reduced, and in the latter case the area of the floats may be reduced. *Patent completed.*

1790. J. Nield and T. A. Nield. *Improvements in moulding or manufacturing pipes, columns, or other similar articles of cast-iron or other metals.* Dated June 17, 1862.

This invention relates to the moulding or manufacturing of faucet pipes, with a faucet either at the top or bottom, with or without snugs, and flange pipes, with or without margins or brackets, and also cylinders, rollers, columns, or shafts, solid or hollow, and either round, square, or of any other form. The patterns are placed half-way through a frame constructed for the purpose, which frame stands in a vertical position, and is fitted with pins to guide the moulding-box to its place; the pattern or patterns are held by hinges, or adjusted to their places by pulleys and slides, or other contrivance, so as to be drawn out by hand or machinery, the said patterns being held in their places by pins fixed for that purpose during the process of ramming. The frame may be so constructed as to admit of pipes, or articles of different diameters, being moulded, and one or more articles at the same time. The boxes are made to hold one or more pipes, or other articles, and are cylindrical, or of any other required form, but they are made in halves longitudinally, and are perforated to allow the escape of gases and steam, and have flanges at the top, bottom, and sides. In the inside of the boxes are flanges, or ledges, to keep the sand from falling out. The flanges on the sides are to fasten the half boxes together, and the flanges at the bottom are to fit on the seating plate, which plate can be made to answer for different sizes, either of socket or flange pipes. The bottom flanges are moulded in the recesses of the plate, which recesses are perforated, hoops being made to fit the seating for different sizes of pipes. The part of the frame boxes and seating which come in contact are forced to fit true to each other. The core barrel has a hoop at each end to enable the cores to be made true, the hoop at the bottom being tapered to fit the seating. This system may be applied to either dry sand or green sand moulding. *Patent completed.*

1791. A. Pringle. *Certain improvements in locks.* Dated June 17, 1862.

This invention consists in the use of six bolt checks, each check being complete in itself, by having its own self-acting spring, and if all the checks were brought into their proper position, they could not be retained so as to let the bolt pass with any instrument or instruments but its own key, a shield passing before the checks, cutting off all communication with the keyhole, thereby making it impossible to pick the lock, and in case of a key being lost or stolen, the checks can have their position changed, thereby making the lost key useless. *Patent abandoned.*

1792. W. Turner and E. T. Loseby. *Improvements in small arms and ordnance, and in sights for the same, parts of which may be used for measuring distances.* Dated June 17, 1862.

The object of the first part of this invention is to enable plain or smooth-bored guns to discharge shot, whether spherical or other shaped, with the accuracy of rifle-bored guns, and to allow of the part which spins the ball being quickly renewed at a small expense. This is accomplished by a twisted rod, or "spit," passing down the bore of the gun, which is secured at the bottom of the breech in such manner that it can be removed when required. This rod may be either square, polygonal, ratchet, or any other form suitable for causing the ball to follow the twist of the rod, and to spin on the gun being discharged. The second part of the invention relates to small arms, its object being to remove certain defects which exist in rifles as usually constructed with the wooden stock, which, extends along the barrel, and is bound to it by bands, or other fastenings. The defects of this arrangement are that, as the barrel and wood expand unequally, both with change of temperature and with moisture, the barrel becomes curved downward by heat, and upward by wet; whereby the ball is thrown out of the path indicated by the sights. The inventors overcome these defects by substituting metal for the ordinary wood support of the barrel. The object of the third part of the invention is to prevent the vibration to which rifle barrels are liable when "short stocked," on account of the barrel not having the wood to stop vibration by acting as a damper, as in the long-stocked rifles, and also diminish vibration in ordnance. This may be effected in different ways, to suit the different kinds of arms. One plan, which the inventors prefer in small arms, is to place a metal rib, or girder, under the barrel, so as to occupy the position of the wood in the ordinary long-stocked rifles. Another plan is to make the gun with two barrels, and place one above the other. A third method is to envelope the barrel in a metal casing. Whatever plan is used, either for small arms or for ordnance, the metal serving as the damper is *not* united to the barrel so as to form a part with it, but is left with the surfaces of the barrel and damper touching each other, so that they may stop vibration, the points of contact along the barrel being so selected as to destroy vibration in the most perfect manner. The fourth part of the invention consists in the construction of a telescopic sight, for ordnance and small arms, which may also be used for measuring distances. The telescope has a narrow band, extending across the cylinder, on the edge of which fine pointed teeth are cut, with deeper notches, to distinguish the fives and tens; this band is placed in the focus of the eye-piece, so that an observer can see the teeth distinctly as opaque points, and be enabled to make any parts of an object in the field of the telescope to coincide with one or more of these points. The telescope is attached to a frame, which allows it to be elevated to suit the range by a screw movement. The frame, including the telescope and other parts of the sight, may be detached from the cannon or small arm, and placed in the pocket. To aim with the sight, the telescope is adjusted to the proper elevation for the range, with the notches horizontal, and the object brought to coincide with the proper point along the scale, to allow for the effect of wind on the shot. To use the sight for measuring the distance of an object, the size of the object must be known; and the number of teeth over which it extends then gives its distance. It is preferred to place the telescopic sight at the side of the ordnance and small arms, so as not to interfere with their ordinary sights. When used for ordnance, it is made to swing so as to keep it vertical. The fifth part of the invention consists in the employment of a screw motion, for elevating the sliding bar of the ordinary back sight, in the use of a spring catch, to fasten the guard on the foresight; and of a hollow square for key, to obviate the projection of a solid square; also in the employment of a globe sight. *Patent abandoned.*

1793. S. Varley. *Improvements in reaping machines.* Dated June 17, 1862.

This invention relates, first, to the cutting instruments used, and consists in the application of a stationary cutter, which has A shaped or angular projections, forming a series of apices forward to the crop to be cut, and somewhat similar to the ordinary reciprocating cutters. The inventor disposes a double-edged lever cutting blade between each of the apices before-mentioned, and pivots it centrally in the rear of each V at the centre of each fixed cutter, and employs a screw as a fulcrum, by which the pressure can be regulated to press the lever cutters on to the stationary cutters, and cause them to cut like a pair of shears. He also uses a bearing point or fulcrum behind the fulcrum proper to form a rest or bearing point to hold up the rear part of the lever cutters, and so insure the proper effect of the regulating screw to keep the cutting edges together. The several cutting levers are jointed, and cut on both edges, while the tails or free ends are each connected by short connecting rods, which connect them with a reciprocating bar, by which a reciprocating motion is communicated to them from the motion of the machine, as usual in reaping machines. The second part of the invention relates to the means and apparatus for the delivery of the cut crop, which he effects by means of a rake or rakes, mounted on an endless chain or chains, wire ropes, or straps, moving in a vertical plane transversely to the forward motion of the machine.—*Patent abandoned.*

1794. W. Clark. *Improvements in the manufacture of buttons, and in apparatus for the same.* (A communication.) Dated June 17, 1862.

This invention relates to the manufacture of buttons of porcelain, bone, india-rubber, and all other substances capable of being moulded and stamped either in a heated or cold state, and whether in a soft paste, or dry and pulverized, or in a mass. These buttons are furnished with a bar or bridge piece contained within the button itself, and of the same material, serving to secure the button in any desired position by passing thread round the said bar. This bar may be formed with the button in various ways. *Patent completed.*

1795. G. Haseltine. *Improvements in roofs for railroad cars, and hurricane decks of vessels.* (A communication.) Dated June 17, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1796. J. Kellow and H. Short. *Improvements in the manufacture of blasting powder.* Dated June 17, 1862.

The patentees manufacture their improved powder thus:—They take nitrate of potash, chlorate of potash, and nitrate of soda (preferring crude nitrate of soda, and using the two nitrates in a state of solution), and with them they combine sawdust, tan, and sulphur. They sometimes, however, dispense with the nitrate of potash, or with the chlorate of potash, or with both the chlorate and nitrate of potash, and sometimes they use either sawdust or tan, instead of both the sawdust and tan. They sometimes manufacture this powder by what they call their "first method," according to which they combine the nitrates and the chlorate, and make into a solution, which they boil and absorb by tan or sawdust, or by both tan and sawdust, and after mixing the materials thoroughly, they add sulphur and dry the compound. The powder produced according to this "first method," is one that will explode suddenly, and is suitable for filling fissures (in blasting cliffs), and other purposes in which tamping or ramming is not required, the powder being, when so prepared, liable to explode during the tamping or ramming. The patentees recommend, when the "first method" is adopted, that the proportion of chlorate of potash should not exceed 25 parts by weight to every 100 parts by weight of the compound to be produced. To produce a strong powder, and with a view to avoid or reduce liability to explode under tamping or ramming, the following, which they call their "second method," can be adopted:—The two nitrates are made into a solution apart from the chlorate, which is made into a separate solution. The solution of nitrates is boiled, and while boiling it is combined with and absorbed by tan or sawdust, or tan and sawdust. Over this mixture they pour the solution of chlorate of potash in a boiling state, and mix well, so that the said solution may be absorbed, and they then sprinkle the compound with flowers of sulphur, and dry it. In this method the nitrates are not boiled or fermented with the chlorate, the object being to avoid danger of explosion during the ramming or tamping. They also manufacture, according to this invention, an improved powder of slow action, by what they call their "third method," in which they do not use the chlorate of potash in a state of solution or liquid, but employ it dry, and in a state of powder, using also a solution of nitrate of soda and nitrate of potash, which they absorb with tan or sawdust, or with tan and sawdust, and add sulphur. The nitrate of potash may sometimes be dispensed with. They sprinkle the chlorade of potash in a state of powder over the tan or sawdust, or tan and sawdust, after the same has been added to the boiling solution of the nitrates, and has absorbed it; and after mixing, they add sulphur, and dry the compound. In this method the chlorate not being dissolved, retains its full strength, and the powder will not be liable to explode during the tamping or ramming. *Patent completed.*

1797. J. Wheater. *Improvements in self-acting and other mules for spinning cotton or any other fibrous substances.* Dated June 18, 1862.

This invention has for its object the prevention of waste in cops spun by self-acting or other mules, and consists in systematically pasting, starching, or sizing, by machinery, the bottom of cops, by having a brush fixed in a box or cover containing paste, starch, or size, which brush, with box or cover, is driven by the friction of the spindles or otherwise along the bottoms of the cops, being conducted on wires placed at suitable distances from the spindles. *Patent abandoned.*

1798. J. H. Johnson. *Improvements in projectiles.* (A communication). Dated June 18, 1862.

This invention relates to various constructions and arrangements of projectiles for ordnance, and consists in a peculiar mode of applying a soft metal zone or belt to elongated projectiles, whereby such zone or belt is not only expanded by the explosion of the charge of the gun, so as to fit more accurately the bore of the gun, but at the same time expresses a certain amount of lubricating material contained in an annular groove or cavity in the surface of the projectile, and, consequently, lubricates the bore, and prevents the rifle grooves from "leading," *Patent completed.*

1799. J. WARREN. *Improvements in ploughs.* Dated June 18, 1862.

In order to attach the share to the body of the plough a screw bolt has, in some cases, been employed; it passes through corresponding holes in the share and body in a direction perpendicular, or nearly so, to the two surfaces it held in contact. This arrangement, however, has disadvantages; unless the share fits the body well, it is not firmly held by the bolt, which only serves for a centre for it to work upon, besides which, the nut, being vertically under the share, is in a part of the body where there is but little space, so that it is somewhat difficult to get at. Now, according to this invention, the patentee makes the bolt, which is bent at its forward end, to pass through the body in a horizontal or nearly horizontal direction, the hole in the share and that in the body being so formed as to admit of this arrangement. The screwing up of the bolt tends to draw the share on to the fore part of the body, until it finds firm bearing points; besides which, the bolt being necessarily longer than before to enable it to pass from the share through the fore sheaf or frame of the body, the nut comes to a part of the body where there is more room for it, and where, consequently, it will be more easily got at. The head of the bolt is bevelled on the face to correspond with the upper surface of the share, and the hole through the upper surface of the share is inclined or bevelled in such manner as to admit of the bent end of the bolt being received into the bevelled hole in the share. The mould board is fixed to the fore sheaf or frame of the body by means of a screw bolt, the head of which is sunk into a recess in the fore end of the mould board; a circular nut fixes the bolt in its place, such circular nut being received into a recess in the frame on the land side of the plough. A land side plate is applied, the fore end of which is bevelled off so as to enter a bevelled recess in the fore part of the frame, so as to produce a level or flush surface, and the plate is retained in position by means of a turn button or buckle. The patentee also, according to this invention, makes the beam of the plough in the form of an inverted trough of wrought-iron; this trough he makes of the required form, and with sides varying in depth in different parts, according to the strain likely to fall on the said parts. Another part of this invention is applicable to compound ploughs, arranged to work in both directions without turning, such ploughs having two shares and mould boards, arranged back to back, or turned in opposite directions. *Patent completed.*

1800. F. COLTMAN. *Improvements in apparatus for discharging coals, minerals, or other substances.* Dated June 18, 1862.

This invention has for its object the diminution of breakage in the discharge of coals, minerals, and other substances, and consists in causing them to be discharged in a direction towards the pit, instead of from it, as usual; that is to say, towards the higher part of the shoot or inclined plane, on to which they are usually discharged, instead of towards the lower part thereof. *Patent abandoned.*

1801. W. E. NEWTON. *Improvements in electrical brushes.* (A communication.) Dated June 18, 1862.

This invention consists in a novel combination with a brush made of wire of an electro-magnet, the poles of which are connected with the projecting wires of the brush, so that when the latter is passed through the hair, or over the surface of the body, a current of electricity shall be conducted to the body, and allowed to act as a remedial agent. *Patent completed.*

1802. W. CLARK. *An improved manufacture of boxes.* Dated June 19, 1862.

This invention relates to that class of boxes known as dry goods boxes, not being applicable for containing fluid matters, and these improvements consist in manufacturing such boxes of paper, card, or millboard, and combining several parts by hoops of metal, which, in addition to securing the parts together, strengthen the boxes and keep them in form. The paper stuff of the boxes may be further combined with cloth, such as is used for book covers, or it may be cheaper woven material, which imparts tenacity to the paper stuff. *Patent abandoned.*

1803. J. L. SMITH. *A universal fire alarum, with discharging apparatus.* Dated June 19, 1862.

This universal fire alarum is formed by attaching, suspending, or fastening a band, strip, line, or any form of gutta percha, india-rubber, or any other substance that is capable of expansion or breaking by the application of heat, to a weight, lever, or spring, so that, on the approach or application of heat, the band, strip, or line of gutta percha, india-rubber, or any other substance capable of expansion or breaking by the application of heat, may expand, stretch, or break, so that the extension, stretching, or breaking of a band, strip, or line, or any form of gutta percha, india-rubber, or other substance, may release or discharge an alarum, either by the immediate action or contact of a spring, weight, or lever, or at a distance by means of a line, wire, chain, tube, or any or all combined. *Patent abandoned.*

1804. G. SPEIGHT. *An improvement in the manufacture of head ornaments.* Dated June 19, 1862.

This invention has for its object a mode of manufacturing head ornaments in order to render them less heavy and less brittle than hitherto. For this purpose, the inventor takes strips or pieces of paper of the required size, and cements them, or otherwise causes them to adhere, to opposite sides of a piece of cloth, calico, or other textile or felted fabric, so as to obtain sufficient body or substance, or the paper may be cemented or caused to adhere to one side only of the fabric. He then dyes or stains the compound material so produced in such manner as to resemble tortoise shell, turtle shell, or other shell. He next embosses it with the desired device in a die and lace perforator, or heats it in such manner as to remove the raised portions and obtain open parts. He afterwards varnishes the substance to get a glossy surface, and bends it into shape by hand or otherwise. He lastly sews, or otherwise attaches it to artificial hair, ribbon, or other material intended to be worn on the head. *Patent abandoned.*

1805. A. HOWAT. *Improvements in the construction of water gauges and blow off taps for steam boilers and other purposes.* Dated June 19, 1862.

This invention consists in constructing the plugs of water gauges and blow off taps, with a longitudinal groove, or with a scraper, the edges of which, when the plug is turned partly round, scrape and loosen the sediment which may have collected in the body of the tap or in the plug. *Patent completed.*

1806. H. RUSHTON. *Improvements in plaiting machines to plait cotton, yarns, silk, or like fibrous materials.* Dated June 19, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

1807. W. STOKES, C. W. JAMES, and J. STOKES. *New or improved machinery for stocking and screwing guns and pistols.* Dated June 19, 1862.

This invention is carried out as follows:—On the bed of the machine a compound slide or saddle works, the said slide having both longitudinal and transverse motions in a horizontal plane. On the said compound slide the stock to be operated upon is fixed by an eccentric clamp, and parallel with the stock a pattern or model is fixed, the said pattern having the figure to be produced in the stock. The said compound slide is moved along the bed of the machine by a rack and pinion, the rack being on the bed of the machine, and the pinion on the lower part of the slide. The upper part of the slide is made to move transversely on the lower part by means of a rack and pinion. Over the bed of the machine, and extending from end to end of the bed, is a dovetail, in which a slide carrying the cutting tool and a fixed guide works. The guide, which consists of a pointed rod, is fixed to the said slide in a vertical position, and the cutting tool, which rotates on a vertical axis, is fixed parallel to the guide. Besides being capable of a horizontal motion in the dovetail, the cutting tool and guide are capable of rising and falling together in a vertical line. The cutting tool and guide are moved by hand, both horizontally and vertically, by means of an arm or lever. Rotary motion is communicated to the cutting tool by means of a pulley and band. The inventors employ about six of the cutting tools, guides, and pulleys on the dovetail slide, each of the said cutting tools being of a different size from the rest, and the stock is brought under one or other of the cutting tools to operate upon different parts. The slide carrying the stock and model can be moved from end to end of the bed of the machine, but the horizontal motion of the slide carrying the cutting tools is very limited. The stock to be operated upon is turned, and the barrel is fitted to it in the ordinary manner before it is operated upon by the new or improved machinery. After the stock and model have been fixed in the slide on the bed of the machine, the rotating cutting tool and guide are brought down upon them respectively, and the slide carrying the stock and model are moved about until the part of the stock being operated upon has been cut to the figure of the model. The position of the stock is changed, and different models are employed from time to time in order to operate upon all parts of the stock where portions have to be cut away. *Patent abandoned.*

1808. R. STANSFIELD and JOHN DODGEON. *Improvements in looms for weaving.* Dated June 19, 1862.

This invention consists, first, in an improved stopping motion for stopping the loom when the shuttle is not in the box. The inventors employ in each shuttle-box that description of swell which is acted upon by the top of the shuttle, but brings the end of the swell to the back of the box, so that, when the swell is held up by the shuttle, its end shall come in contact with a lever on the stop rod, and hold up the stop rod finger; but when the shuttle is not in the box, the end of the swell shall not be in contact with the lever, and thereby allow the stop rod finger to be depressed and come in contact with the frog and stop the loom. Secondly, in an improved arrangement of buffer or check strap. The inventors coil one end of the strap round a concentric or eccentric boss fixed to the slay or lathe, instead of fixing it to the end of the strap itself, by which means there is greater elasticity and prevention of wear and tear than in any other method. Thirdly, in an improved mode of stopping the loom when the weft thread breaks, or when there is no weft. The inventors place the weft fork on the opposite side to the setting on rod, and instead of placing the hammer on a stud, they fix it to a shaft or tube, having upon it a lever which is acted upon by the absence of the weft, and also at the other end another lever which operates upon the setting on rod or spring handle and liberates the brake, so as to stop the loom at the breakage or absence of the first pick of weft. *Patent abandoned.*

1809. C. CARTWRIGHT. *Improved means of stopping or retarding trains on railways* Dated June 19, 1862.

This apparatus is intended for stopping railway trains in the event of a threatened collision or accident, and consists, principally, of two strong vertical iron bars working or sliding in elongated stirrups attached in juxta position to the bottom of each railway carriage. On the upper portion of these bars are spiral springs, kept on by collared nuts with linch pins, which nuts are turned up round the rims (as also are the bottom of the stirrups), to prevent the springs from expanding and slipping off. The other or lower ends of the sliding bars are to be formed as hooks, being perforated at about eight or ten inches from the hooks to admit guiding rods adjusted at the bottom of the carriage. Under these hooks, and working upon the guiding rods, and kept up by spiral springs, having collared nuts and linch pins, is a strong iron bar (which the inventor calls the "director") working upon the guiding rods, having a strong stop joint in the middle to allow of its falling in a straight line. The bar or director, when not in use, is drawn up towards the bottom of the carriage by a chain passing over a roller or sheave fixed to the bottom of the carriage, and, running under another roller or sheave fixed on the bottom at the back of the carriage, is jointed to a sliding bar working on guides fixed to the back of the carriage, and rising a little above the roof, having a perforation to admit of a spring bolt, which is fixed on the roof, and by which bolt the whole apparatus is held up clear of the wheels. The spring bolt is attached to a connecting wire running along the roof of the carriage from back to front, and is joined by a chain to a similar wire running along the roof of the preceding carriage, which wire is also joined by a chain to the spring bolt on the top of the next carriage, and so on to the first carriage of the train, on which the wire is a little shorter, and is fixed by a flattened chain passing over a roller mounted on a lever attached to the front of the carriage, to prevent the wire from being bent by its being raised or depressed. In case of a threatened collision, or danger, or whenever the engineer wishes to stop the train suddenly, after shutting off the steam, he depresses the last-named lever, and thus withdraws all the spring bolts at once, and the sliding bars descending allow the directors to fall into a straight line, and directing or thrusting the hooks of the sliding bars between the spokes of the wheels, the latter are prevented from revolving, and the train is stopped. The spiral springs on the sliding bars and guide rods then come into action, and prevent or diminish the jerk which might otherwise be seriously felt. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Sept. 12, 1862.

2520. G. Bedson, Manchester, manager. Improvements in rolling wire and other rods or bars of metal.

Dated Nov. 14, 1862.

3070. H. Morgan, Liverpool, iron turner, and J. Parkinson, machine fitter. Improvements applicable to weighing machines, part of which may be used to measure liquids.

Dated Nov. 15, 1862.

3077. A. and H. Illingworth, Bradford, York, spinners. Improvements in washing wool and other fibres.

Dated Nov. 18, 1862.

3096. E P. Houghton, Liverpool, Lancaster, wine and spirit merchant. An improved method of applying breaks or apparatus for stopping or retarding railway carriages.

Dated Dec. 5, 1862.

3266. P. Cowan, Hammersmith-bridge Soap Works, Barnes, manufacturer. An improved method of purifying gas.

Dated Dec. 6, 1862.

3270. H. A. Bonneville, Paris. Improvements in the manufacture of stockings and socks. (A communication.)

3280. J. Joce, Colchester, surgeon. An improved composition or compositions for producing artificial sea water, or the odour or effects of sea water.

Dated Dec. 10, 1862.

3308. L. A. Lesage, 2, Rue Sainte-Appoline, Paris, merchant. An improved method of preparing jellies and jams.

Dated Dec. 15, 1862.

3350. M. Hyams, 55, Bath-street, City-road, cigar and pipe manufacturer. Improvements in the manufacture of cigars, cheroots, and cigarettes, and in the treatment of tobacco.

Dated Dec. 17, 1862.

3375. F. De Wylde, Great College-street, Camden-town. Improved means for the protection and preservation of lead surfaces exposed to the action of water, and for the protection of such surfaces from decomposition by atmospheric action. (A communication.)

3376. L. Latter, Leigh, near Tunbridge, farmer. Improvements in ploughs.

Dated Dec. 18, 1862.

3392. S. C. Lister, Manningham, York. Improvements in preparing, combing, and spinning, flax, silk, and other fibrous material.

Dated Dec. 24, 1862.

3448. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved construction of skate. (A communication.)

Dated Dec. 26, 1862.

3454. E. T. Loseby, 124, Wood-street, Cheapside, horologist. Improvements in the construction of instruments for ascertaining the pressure, and the moving force of the atmosphere.

Dated Dec. 27, 1862.

3556. W. H. Samson, Underhill, Wittersham. Improvements in certain machinery for cultivating land by steam power.

3458. J. and S. Freemantle, Gosberton, Lincoln. Improvements in apparatus for propelling vessels.

Dated Dec. 29, 1862.

3460. M. Ker, 14, Camden-street, St. Pancras. An improvement in wardrobes or other pieces of furniture or fittings, with glass silvered doors or panels used for toilet purposes.

3462. J. H. Riddell, 155, Cheapside, hot water engineer. Improvements in cast metal or other pipes or tubes for conveying gases, fluids, or vapours, and in the mode of connecting such pipes or tubes.

3466. G. Haseltine, No. 12, Southampton-buildings, Chancery-lane. Improvements in cartridges, and in the mode of charging small arms and ordnance (A communication).

3468. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in preserving organic substances from decay. (A communication).

Dated Dec. 30, 1862.

3472. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in ingot moulds employed in the casting of steel and other metals. (A communication.)

3476. W. Mould, Belmont, near Bolton, dresser. Certain improvements in machinery or apparatus for plaiting or folding and measuring fabrics.

3478. W. Richards, Birmingham. Improvements in cannon and other firearms, and in apparatus connected therewith.

Dated Dec. 31, 1862.

3488. F. Jaques, Nelson-terrace, Stoke Newington, gentleman. Improvements in cases for pipes, mouth-pieces, cigars, and other analogous articles.

3490. W. Maltby, De Crespigny-park, Camberwell, gentleman. Improved means of extinguishing fires by the use of substances not hitherto so applied.

Dated Jan. 1, 1863.

2. W. H. Brown, Sheffield, iron master and steel manufacturer. Improvements in battery plates.

6. R. Faulds, Glasgow, waggon builder. Improvements in traction engines or common road locomotives.

8. J. Jones, manager, Rhodes, Lancaster. Improvements in finishing or stiffening textile fabrics.

10. W. Robinson, Birmingham, manufacturer. An improvement or improvements in glasses for lamps used in ships, railway carriages, and for other like purposes.

INVENTION PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF A COMPLETE SPECIFICATION.

Dated Dec. 31, 1862.

483. F. Applegate, Bradford-on-Avon, cloth manufacturer. Improvements in the manufacture of a kind of woollen cloth, known to the trade as deerskin.

LIST OF SEALED PATENTS.

Sealed Jan. 13th., 1863.

2019. C. and J. W. Crossley.
2023. P. A. L. Canonicat.
2024. G. Fawcus.
2025. F. M. Parkes.
2026. O. P. Drake.
2028. A. Leslie.
2029. A. Couvreux.
2030. J. Green.
2031. A. Couvreux.
2033. W. Dickens.
2034. C. E. Crawley and F. Foster.
2037. G. T. Selby.
2039. W. Henson and W. W. Clay.
2044. J. Dickson.
2048. T. B. Daft.
2050. W. Gossage.
2056. R. A. Brooman.
2058. A. B. Brown.
2059. G. J. Yates and J. W. W. Tindall.
2066. T. H. Saunders and J. Millbourn.
2082. J. Daniels.
2088. T. King.
2092. J. J. Haley.
2101. J. Dickson.
2120. E. Tysall.
2126. R. Low and W. Duff.
2168. J. W. Dixon.
2169. J. W. Woodford.
2171. W. Weild.
2180. G. Haseltine.
2193. G. Coles, J. A. Jacques, and J. A. Fanshawe.
2242. W. Clark.
2253. J. Dickson.
2452. W. E. Bovill.
2527. H. Bennett.
2837. J. Duke and J. Cleaver.
2938. H. L. Corlett.
2956. M. Merryweather, R. M. Merryweather, and E. Field.
2961. J. Winter.
3060. R. and P. Sykes.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2953. X. C. de Nabat and A. C. de Nabat.
31. A. Chambers.
39. J. Knowles.
46. E. J. Harland.
72. J. Jameson.
70. W. Cotton.
82. C. De Bergue.
58. P. Czugajewicz.
328. J. R. Cooper.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

53. S. C. Litter and W. Tongue.
87. W. Smith.
92. H. Emanuel.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

2392. G. Cooke. Securing or fastening doors.

2418. E. G. Fitton. Machinery for winding yarn or thread on to bobbins or spools.

2434. C. Garton. Applying heat in the manufacture and refining of sugar.

2438. W. H. Atkinson. Studs or fastenings.

2439. W. Clark. Musical instruments. (A communication.)

2440. E. Dyson. Throstle, spinning, and doubling machines.

2443. P. J. Bossard. Stoppers. (A communication.)

2447. J. Platt and W. Richardson. Burning of bricks and tiles.

2348. H. L. Emery. Ginning cotton.

2450. J. Platt and W. Richardson. Manufacture of bricks and tiles.

2451. W. Slater and W. R. Harris. Self-stripping carding engines.

2453. H. W. Hart. Argand and other burners.

2459. J. R. Johnson and J. A. Harrison. Taking photographic panoramic pictures.

2460. S. H. Huntly. Cooking apparatus.

2461. J. Snider, jun. Increasing the durability of, and for preserving cloths.

2462. S. Pudney. Manufacture of sulphuric acid.

2463. H. Hughes. Fluting or goffering machines.

2464. E. L. Duncan. Manufacture of splints.

2469. F. D. Artingstall. Balances.

2471. J. Whitehead. Looms.

2472. J. Hartshorn and W. Redgate. Manufacture of lace fabrics.

2474. G. W. Belding. Wringing machine. (A communication.)

2481. W. Hirst. Manufacture of paper or linen spool tubes.

2487. W. Rothera. Rivetting boiler plates.

2489. J. Vigouroux. An inoxydable white metal, suitable for making taps or cocks.

2493. A. Rigg, jun. Carrying and tipping coal and other minerals.

2497. G. Weeks. Constructing frames, trays, pots, or holders for flowers, plants, or shrubs.

2500. J. Hemsley. Fabric or material for scarfs, ties, handkerchiefs, and neckerchiefs.

2501. R. A. Brooman. Cultivating the soil. (A communication.)

2510. A. Whytock. Coated and uncoated sheet-iron boxes.

2512. J. B. Smith. Washing and mangling machines.

2514. J. R. Johnson and J. S. Atkinson. Printing types.

2518. A. J. Moreau. Reducing or melting pulverized metals or metallic ores.

2520. G. Bedson. Rolling wire and other rods or bars of metal.

2535. J. Webster. Manufacture of nitric and nitrous acids, and other nitrogenous compounds.

2542. W. Clark. Treatment of peat and peat tar. (A communication.)

2550. J. Simpson. Composition for coating or covering moulded or other surfaces.

2557. P. H. Whitehead. Support or stand.

2576. C. Chinnock. Construction of cork screws.

2646. J. Bucknall. Construction of horse hoes.

2650. W. and W. Carrick. Felting apparatus.

2653. J. L. Hughes. Producing ornamental patterns.

2792. G. T. H. Pattison. Embossing or finishing woven fabrics.

2793. G. T. H. Pattison. The imparting of an improved surface or appearance to fabrics woven with mixed materials.

2940. D. Spink. Propelling.

3068. W. H. Andrew. Scissors and shears.

3234. G. T. Bousfield. Apparatus for discharging guns or ordnance. (A communication.)

3257. J. Biggs, J. Johnson, T. Richardson, and T. Arnold. Manufacture of warp fabrics.

3427. G. Haseltine. Converting petroleum or coal oil into gas. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending January 16, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
1402	1	0	1632	0	4	1643	0	8	1654	0	10	1665	0	10	1676	0	8
1611	1	8	1633	0	4	1644	0	4	1655	0	8	1666	0	10	1677	0	8
1623	0	4	1634	0	10	1645	1	0	1656	0	4	1667	0	4	1678	2	8
1624	1	2	1635	0	4	1646	1	0	1657	1	0	1668	0	8	1679	0	4
1625	0	4	1636	0	8	1647	0	4	1658	0	4	1669	0	4	1680	0	6
1626	0	6	1637	0	8	1648	0	10	1659	0	4	1670	0	8	1681	1	0
1627	0	4	1638	0	4	1649	0	4	1660	0	4	1671	0	4	1682	0	4
1628	0	4	1639	3	0	1650	1	4	1661	0	10	1672	0	4	1683	0	10
1629	0	4	1640	0	6	1651	0	6	1662	1	2	1673	0	10	1684	0	10
1630	0	4	1641	0	10	1652	0	4	1663	0	8	1674	0	6	1685	0	4
1631	0	6	1642	0	4	1653	1	6	1664	0	8	1675	4	2	1686	0	4

13782* .... 6d.

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER—Per Load.

	£	s.	d.
Teak	15	0	0
Quebec, oak, white	6	10	0
„ Birch	3	10	0
„ Memel	5	0	0
„ Elm	6	10	0
„ Fir	3	10	0
„ Red pine	6	0	0
Dantsic oak	6	10	0
Quebec Yellow pine	4	0	0
St. John, N.B., yellow	5	10	0
Memel fir	3	5	0
Riga	3	5	0
Swedish	2	15	0
Deals, per C., 12 ft, by 3 by 9 in.			
Quebec, white spruce	19	11	0
St. John, white spruce	16	10	0
Yellow pine, per reduced C.			
Canada, 1st quality	18	10	0
„ 2nd do.	12	0	0
Archangel, yellow	13	10	0
St. Petersburg, yellow	12	0	0
Finlan	10	0	0
Memel	15	0	0
Gothenburg, yellow	11	0	0
„ white	9	10	0
Gefle, yellow	11	10	0
Soderhamn	10	10	0
Christiana, per C. 12 ft. by 2 by 9 in. yel.	23	0	0

OILS, PAINTS, AND DRYSALTERIES.

	£	s.	d.
Lead, red	21	10	0
„ white	27	0	0
Oil, Seal, pale, per 252 gallons	48	0	0
„ yellow	47	0	0
„ Sperm	86	0	0
„ Cod	47	0	0
„ South Sea	43	10	0
„ Olive, Gallipoli, per tun	61	0	0
„ Palm, per tun	40	0	0
„ Cocoa-nut	57	10	0
„ Rape, pale foreign	52	10	0
„ Linseed, per cwt.	41	5	0
Rough, Turpentine, per cwt.	1	2	0
English spirit, without casks	4	0	0
Hemp Manilla	35	0	0
Jute	22	15	0
Hemp Rope	25	10	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
IRON :									
Welsh Bars, in London	per ton	6	15	0	to	7	0	0	2½
Nail Rods	„	7	10	0	„	7	15	0	„
Hoops	„	8	10	0	„	9	0	0	„
Sheets, single	„	9	5	0	„	9	10	0	„
Staffordshire Bars	„	7	15	0	„	8	0	0	„
Bars, in Wales	„	5	10	0	„	6	0	0	„
Rails	„	5	15	0	„	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	„	2	14	0	„	2	17	6	„
Swedish Bars	„	11	10	0	„	12	0	0	2½
STEEL :									
Swedish Keg, hammered	„	16	0	0	„	0	0	0	„
„ Faggot	„	17	10	0	„	18	0	0	„
COPPER:									
Sheet and Sheathing, and Bolts	„	105	0	0	„	0	0	0	3
Hammered Bottoms	„	115	0	0	„	0	0	0	„
Flat Bottoms, not hammered	„	110	0	0	„	0	0	0	„
Tough Cake and Ingot	„	98	0	0	„	0	0	0	„
Tile Copper	„	98	0	0	„	0	0	0	„
Best Selected	„	101	0	0	„	0	0	0	„
Composition Sheathing Nails	per lb.	0	0	11	„	0	0	0	„
Yellow Metal Sheathing and Rods	„	0	0	9½	„	0	0	0	7½
Fine Foreign	per ton	98	10	0	„	100	0	0	3
TIN :									
English Block	pr cwt.	115	0	0	„	0	0	0	2½
Bar	„	116	0	0	„	0	0	0	„
Refined	„	120	0	0	„	0	0	0	„
Banca	„	119	0	0	„	120	0	0	nett
Straits	„	117	0	0	„	118	0	0	„
TIN PLATES :									
Best Charcoal, I.C.	pr box	1	8	6	„	1	9	0	3
Second Quality	„	1	6	6	„	1	7	6	„
Coke	„	1	2	6	„	1	4	0	„
LEAD :									
Pig, English	per ton	21	10	0	„	22	0	0	2½
Spanish, Soft	„	20	10	0	„	20	10	0	„
Shot, Patent	„	23	10	0	„	0	0	0	„
Sheet	„	21	10	0	„	21	15	0	„
White	„	27	0	0	„	27	10	0	„
SPELTER :									
On the spot	„	18	0	0	„	18	5	0	nett
ZINC :									
English Sheet	„	23	10	0	„	0	0	0	2½
QUICKSILVER	pr btl.	7	0	0	„	0	0	0	3
REGULUS OF ANTIMONY :									
French Star	per ton	42	0	0	„	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 23, 1863.

ON SAFETY LAMPS FOR MINES.

FEW still unsolved problems have more exercised man's ingenuity than that of safely illuminating the mines of bituminous coal, subject to the irruption of fire-damp. In the beginning of this century, a contrivance called the "steel mill," as also the phosphorescence of some kinds of decayed animal matter, were in use for the purpose. The steel mill consisted of a notched steel wheel revolved against a piece of flint by a boy, while the miner plied his trade by the resulting dim light.

Baron Humboldt and several other men of science, in the beginning of this century, directed their attention to the discovery of some safe means of illuminating "fiery" mines. This was before Sir Humphrey Davy, the chemist, and George Stephenson, the engineer, simultaneously, in 1815, brought out the present safety lamp. It may perhaps be said, with propriety, that Davy first *discovered* and published the scientific principle on which is based the comparative safety of the lamp, and that Stephenson first *invented* a practical lamp. It certainly was an extraordinary instance of a man of science and a man of practice meeting each other half way in an important and original invention. Be that as it may, neither "Davy" nor "Geordy" lamps entirely fulfil the conditions of safety. Numerous patents and contrivances have since been brought forward, with more or less success, to render these lamps safer, and to increase their illuminating power. Last week we illustrated one of these inventions. It is a common sense application of the hollow argand wick to the miner's lamp. The tubular wick, while it affords a better light, at the same time gives additional security, as an argand wick requires much less trimming than the flat wick. We have not seen a hollow wick employed in a miner's lamp before, and this is another instance of a very simple idea, or application, having to wait for years to be put to special ptactical use.

Induced electricity is now being tried by MM. Dumas and Benoit, the French chemists, as a safe light for mining operations. The apparatus consists of a Ruhmkorff's coil, an element of a pile, and, lastly, one of Geysler's glass tubes, the whole being so arranged as to give a light sufficient for working. The light produced does not heat the tube, and it cannot be reached by the gas. The apparatus is said to be completely isolated, and its construction is as strong as the present ordinary safety lamps. We hope to hear further about this scheme. The awful annual destruction of life in Great Britain, through fire-damp, is a disgrace to science. There does not seem to be so many lives lost in the Belgian and foreign mines generally as with us. The Government supervision in those countries, while it certainly impedes the free and unrestrained development of commercial enterprise, seems, at the same time, to give more security to the lives of the men employed.

The commonly received opinion, and the theory upon which Davy based his safety lamp, is the following:—A mixture of carburetted hydrogen (or common lighting gas) and atmospheric air is not inflammable without the *presence of flame*. It is, therefore, supposed that a red hot iron would not light the gaseous mixture. The combination of the carburretted hydrogen and atmospheric air must also undergo a high temperature to get inflamed. An explosive mixture can thus enter a lamp surrounded by a wire gauze or a perforated cylinder, and can there get lighted, but it is isolated from the mixture outside by means of the heat absorbing powers of the cylinder.

The Belgian engineer, Ponson, in his "*Traité de l'explirtation des Mines de la Nouille*," gives the following as the results of general experience with the Davy safety-lamp:—

1. A wire gauze cylinder, the meshes of which are properly proportioned as to size and number, affords, for a certain time, complete security in a mixture of fire-damp and atmospheric air. This is only in case the fire-damp is not in motion, and is not mixed with other inflammable gases.

2. The wire-gauze cylinder of a good lamp keeps the flame from spreading for only 20 minutes, sometimes even less. The wire-gauze is destroyed by the combustion of the gas inside the cylinder.

3. The inside of the chimney always shows the state of the air of the mine. It does not merely indicate the presence of the gases, but also their average proportion to the atmospheric air that is present.

If the proportion of fire-damp is small, the flame of the lamp shows the presence of fire-damp by its greater length and size. If the carburetted hydrogen should form 1-12 of the whole volume, the gauze cylinder is then filled with a light blue flame, the intensity of which increases with the quantity of the gas. If the fire-damp forms 1-6 or 1-5 of the mixture, the blue flame is then so powerful that the flame of the wick entirely disappears.

Should the atmospheric air increase, the flame of the wick reappears, but it is completely extinguished, if the fire-damp be in the proportion of 1-3 to the centre volume of air.

4. Many experiments have shown that when the lamp is placed in a *current* of pure hydrogen, an explosion is transmitted through the meshes to the outside. If, however, the current consists of ½ or of ¼ of carburetted hydrogen gas, and the remainder of pure hydrogen, the explosions are then confined to the interior of the gauze cylinder.

5. The flame of the lamp is not conducted to the outside, even if several meshes become united, or if there be holes 3 to 5 millemetres diameter (⅛ to ¼ bare) in the gauze, *if only these faults be about* 0·06 *metres to* 0·08 *metres* (2⅜ *to* 3⅛ *inches*) *above the flame of the wick.* In this case the flame appears to twist itself within the cylinder. This remarkable fact recalls to mind the theory upon which George Stephenson proceed in constructing his lamp. "Stephenson related to the Committee of the House of Commons, which sat on the subject of Accidents in Mines in 1835, that he imagined that if he could construct a lamp with a chimney at the top, so as to cause a strong current, *it would not fire at the top of the chimney*; as the 'burnt air' would ascend with such a velocity as to prevent the inflammable air of the pit from descending towards the flame; and such a lamp, he thought, might be taken into an explosive atmosphere without risk of exploding."

Should there be, however, an opening of even less than two millimetres (0·078 in.) at about the height of the wick, an explosion takes place. This is particularly the case if the stream of gas, or of the detonating mixture, be directed towards the bottom part of the cylinder. The following deductions result from experiments;—That the flame of all safety lamps has a tendency *towards* the blast of the gas, and not *upwards*, in the direction of the consumed gases in the lamp. According to this, any injuries at the top of the cylinder do not much diminish the safety of the lamp.

6. The safety of a Davy lamp is diminished by increasing the size of the gauze cylinder.

7. The wire gauze gets red hot when placed in an inflammable mixture of air; but this does not take place, and the gauze remains black, if the gases be of an explosive kind.

8. Davy soon found that a stream of explosive gas, when directed *against* the flame, could pass through it, and cause an explosion. A velocity of 300 ft. per minute was sufficient to produce an explosion.

9. The illuminating power of a Davy lamp is much less than that of a candle or an uncovered lamp. Various schemes have been tried to obviate this. Parabolic reflectors of copper have been placed in the inside of the lamp. Plano-convex lenses have also been applied to concentrate the flame on the point required to be illuminated. Most of these plans have, however, been abandoned.

It has also been proposed to place inside the wire gauze tube several thin spiral wires of platinum, in order that the miner should have light, even when the flame had been extinguished. It was supposed that a mixture of fire-damp contained a certain amount of pure hydrogen, and that the decomposition of this gas, when under the influence of the platinum, would keep the platinum at a white heat, and thus afford sufficient light to the miner. On the lamp arriving into a purer atmosphere, the heated platinum would then light the mixture of gas, and thus re-light the wick.

This plan, however, has not been successful, for obvious reasons. We have now alluded to the generally received opinion that red hot iron could not inflame fire-damp. It is probable that this opinion is liable to some modification. The combustion of a quantity of fire-damp requiring a certain temperature, the required temperature would be obtained by the presence of a large mass of hot iron, or by the fact of a current of gas being in motion at a high speed against a smaller mass of hot iron. We will quote the following out of the "Transactions of the Northern Institute of Mining Engineers" for 1853. Mr. Greenwell stated that:—

"On Friday, May 27th, 1853, he, in company with Mr Simpson, made some experiments at Townley Colliery, in order to ascertain the effect of placing red-hot iron in contact with light carburetted hydrogen gas. The gas, which may be termed 'washed gas,' as it passes through a drowned drift in the three-quarter seam of this colliery, is conveyed by means of a pipe in the shaft to the surface; it then passes through naptha into a gasometer, and thence to various burners in the shops and elsewhere. There is also a cock between the top of the shaft and the naptha vessel, whence, when opened, the gas issues in its natural form. The first experiment consisted in placing a bolt, about two inches in diameter, heated to a cherry red, in contact with the napthalized gas, in the smith's shop. The gas was immediately inflamed; in a short time, however, the iron, still at a good red heat, ceased to possess the power of exploding the gas.

"Precisely the same effects were produced when the iron was applied to the cock between the pit and the naptha vessel.

"The next experiment consisted in applying a Davy gauze, similarly heated, to the issuing gas. An immediate explosion, *inside of the gauze*, was the result, and this was repeated several times; the flame, however, did not pass through and ignite the external gas.

"From this it appears that the *mass* of hot iron applied to the gas was the occasion of its explosion, acting in the first instance by heating the gas, and in the next by igniting it when so heated; *for when iron in the condition of wire gauze, although equally hot, was applied to the current of gas, instead of the iron in the first place heating the gas to such an extent, the gas operated in cooling the iron externally after; however, the gas had passed through the gauze into its interior; it had acquired a sufficient degree of warmth to enable the opposite side of the cylinder, still red hot, to explode it.*

"If the above theory be correct, it follows that when the rapidity of the current of gas is such that the whole of the quantity passing into the gauze (supposing it to be red hot) cannot be consumed within the gauze, the surplus in a heated state must pass through, and be very liable to explode."

In the discussion that followed the reading of the above paper, Mr. Nicholas Wood, the president, recalled the fact that the gas experimented upon had passed through water, and he raised the question whether this had not given any additional inflammability to the gas.

"The gas, when tested by a heated Davy gauze, did not fire at the first wires, or in passing into the lamp; the wires, it appeared, had the effect of heating the gas as it passed through, and then, when it came to the other side of the lamp and approached the red-hot wires, it exploded. Mr. Greenwell explained that the experiments with the gauze were made with gas after it had passed through *naptha*; but in the experiments with iron there was no difference between passing the gas through naptha, and not doing so. Mr. Greenwell also stated that the gas was at the ordinary pressure, and that the explosions occurred in about a second after the gas passed through the wires, while there was the same apparent degree of heat in the whole of the experiments."

It will be seen by the above that the so-called Safety lamps gives very insufficient safety to our brave miners. The safety is dependent upon the chance chemical composition of the gases. It is further dependent upon time; a period of time limited by the destruction of the wire gauze under the influence of heat generated by the combustion of the gas within the cylinder. A current of fire-damp exceeding a certain speed, and directed against the wire gauze cylinder, will cause an immediate explosion. The size of the cylinder of the common Davy must be kept within certain limits. A very small rent in the gauze at the level of the flame will cause an explosion. The maximum space between the meshes, consistent with a limited safety appears to be less than 0·078 inches. So that a literal Damocles' sword of fire is suspended by a thread above the heads of those working in a fiery main. The "Geordy," or George Stephenson's lamp, consists of an ordinary lamp with a tall glass cover, the whole being again covered by a double casing of plate perforated with holes, through which holes the air passes to feed the combustion inside. A great security is afforded by the "Geordy," from its extinguishing itself when placed within a highly-explosive atmosphere. The wire gauze of the "Davy" gets red hot under the same circumstances.

It appears that George Stephenson was of opinion that a combination of his own glass tube with Sir Humphrey Davy's gauze cylinder would give the greatest safety, and the best light. An unprotected glass ring, however, must be a source of some danger. This has been tried, and many lamps are used made in this way. In George Stephenson's lamp, and other lamps, where the air required for combustion descends from the upper part of the lamp, great security is given from the flame getting extinguished when the lamp is placed in an inflammable atmosphere. When the fire damp gets lighted in the casing, the resulting gaseous products, not having time to escape, remain in the cylinder, and mingle with the fire-damp as it enters the casing. While this is going on, the carbonic acid gas accumulates at the bottom of the cylinder, and these united agencies render it impossible for the flame of the wick to continue in a state of combustion. It is thus out of the question for the most careless man to continue working, and a solemn warning is given him that fire-damp is present.

A miner's safety-lamp is something like a steam boiler safety-valve. The security given by a good safety-lamp in a mine is like the kind of security given by a safety-valve on a boiler. A safety-lamp shows the proportion of explosive gases in a mine, just as a safety-valve can be made to show the steam pressure in a boiler before that pressure gets to be dangerous. Neither of these two apparatus afford absolute safety, but, handled with ordinary care, under ordinary circumstances, they both prevent disastrous explosions.

The dreadful destruction of valuable life in the mines of Great Britain result from many causes. The most prominent cause, however, is fire-damp; and in many cases the irruptions of this gas are so sudden and voluminous, that scarcely any amount of ventilation can dilute the carburetted hydrogen sufficiently to prevent it igniting at a naked light. A truly safe lamp is thus an imperative necessity; and there still exists a deplorable, and even disgraceful, degree of uncertainty as to the one best mode of constructing such a lamp.

We have often heard working miners express much surprise that more had not been done to give them a better and safer light. We will venture to assert that £50 in the hands of an ingenious man of science, experimenting for this object, would do more lasting good than the same money spent in the charitable subscriptions resulting from the thrills of pity and horror at the mining disasters that continually electrify the country.

Men of science, meditating by a good coal fire, still owe an unliquidated debt to the brave hearts and hands labouring to furnish society with such absolute necessities as heat, light, and power.

H.

SHAND AND MASON'S FIRE ENGINE MANUFACTORY.

We have lately inspected with some interest the new workshops belonging to the above mechanical engineers, lately erected in the Blackfriars-road. New workshops are always more or less interesting to a mechanic, as they are necessarily always more or less up to the mark as regards new tools and new arrangements. Messrs. Shand and Mason's factory appears to be completely furnished with new machinery, chosen with very little regard for expense. We believe that about one hundred men are employed at present. This firm has been known for nearly a century in the metropolis as a purveyor of fire-engines, pumps, and other apparatus for limiting the destruction of life and property by fire—that good servant but bad master. The establishment owes its first beginning to Mr. Samuel Philips, in 1774, who also patented the chain-pump used by the royal navy. Mr. Philips was elected an honorary member of the Society of Civil Engineers, and in 1780 he was appointed engine and pump maker to the Honourable Board of Ordnance. Mr. J. Hopwood succeeded this gentleman. Mr. Hopwood's manager and late successor, Mr. W. J. Tilley, greatly extended the business, and introduced steam power into the workshops. In his turn, also, Mr. Tilley retired in favour of the present partners, Messrs. J. Shand and S. Mason. Mr. Shand held for several years the same position with Mr. Tilley, as the latter gentleman towards his predecessor, Mr. Hopwood, having been Mr. Tilley's foreman and manager for several years. Messrs. Shand and Mason have lately appeared before the public with some degree of prominence, as manufacturers of steam fire-engines. As is well known, Mr. John Braithwaite, civil engineer, was the first to make and use this powerful class of fire-extinguishing apparatus. He brought out the steam fire-engine some twenty years ago. With our national horror of novelty, it was not taken up at the time, and Mr. Braithwaite had to abandon it, after much expense and labour to himself. Not so, however, with our clever and enterprizing cousins across the Atlantic, with whom hand labour is scarce, and who have no such antipathy for novelty merely because it is new. Accordingly, Mr. Braithwaite's steam fire-engine, though rejected in England, has been for years in successful operation in that lately happy country, the United States of America. The success of the American fire-engines suggested to Messrs. Shand and Mason the feasibility of introducing them into England. In this design, the firm was unsuccessful for some time; but at last, in April, 1860, the London Fire Brigade agreed to hire on trial for twelve months a fire-engine, constructed at the expense of Messrs. Shand and Mason. This steam fire-engine was found so serviceable, that it was purchased, and several others were ordered, all of which are now in use by the London Fire Brigade. Mr. Lee's American steam fire-engine was, we believe, first tried at Messrs. Hodges's distillery in April, 1862, and it is the same engine that was exhibited in the nave of the International Exhibition.

In 1852 the largest and most powerful fire-engines in London consisted in two river engines that belonged to the London Fire-engine establishment. The largest of these two engines was worked by 120 men. In the same year steam power was substituted for hand labour on the largest of these two engines. Experience having shown the great advantages of this substitution, the directors of the London Fire-engine Establishment ordered an entirely new floating steam fire-engine of Shand and Mason. The engines drive the boat or work the pumps, as required. They are of 80-horse power, nominal, but they can work up to double that amount, throwing 2,000 gallons per minute through "8:1½ inch jets," 150 ft. high.

The workshops of this establishment appear to be as well arranged as is consistent with the limited space that can be obtained in a large town. They are disposed in several stories, and the buildings enclose an open yard where the finished fire-engines are tried. Of course, the most convenient, and, in the long run, the most economical system of constructing engineering workshops, consists in building them all on the ground floor. The saving of labour to the men in climbing up and down some 20 times a day, the superior light for the machine tools obtained by skylight windows, are among the advantages obtained by one-storey erections. The engines and the heavy reciprocating tools have all firm unshakeable foundations, the absence of which always leads to a gradual but certain deterioration of machinery. The shafting can be easily and simply arranged. A distinct *coup d'œil* is attained of all the men engaged at their work. Only a man who has himself been an operative knows the advantages to an employer in the foreman's office being placed so as to overlook the whole workshop. The entire area of a one-storied building can be covered with machine tools, as the skylight windows throw an abundance of light on any position. This arrangement, however, can only be adopted in favourable situations, where land is cheap.

In every special manufacture there ought to be special way of arranging the machinery and buildings. It may almost be said that this is of itself a branch of engineering. Of course, much will depend on the situation; and easy communication, accessibility of skilled labour, abundance of water, the future extension of the particular business, &c., would all be points to be considered. In fact, we should say, that an engineer, in arranging a manufactory for any special purpose, should design it in the same way as he would also design a machine for any special work. To the manufacturer, his factory is but a large special machine. If establishments were oftener laid out according to some proper plan, schemed before hand—with due regard to future extensions, we should not see so many senseless agglomerations of bricks and mortar as we do at present. These are not merely eye-sores to anybody with a view to order and symmetry, but they cause a perpetual loss of money. If time be money, labour is also money; and for every cwt. uselessly moved about, whether by animal or steam power, a certain amount in cash is thrown away. The materials on manufacturing should always advance forward, and should be as little as possible taken back over the old ground.

The first thing in Shand and Mason's manufactory at strikes an eye accustomed to the ordinary routine of mechanical workshops, is the great abundance of gun metal castings used in constructing the fire-engines. The greater expense of this metal is of course compensated by its superior durability, in contact with various kinds of water; and its lesser liability than cast-iron, to injury from rough usage. The erecting shop is built in the centre between the tool and fitting shops, on the ground floor and first storey. A travelling crane is erected so as to traverse above the whole, and all these shops are thereby in complete communication with each other, as the work to be removed can be traversed diagonally, as it were, from the shops on the ground floor to those above. We have seen the plan carried out in Lancashire, in a rather neater way, with slender cast-iron columns, &c. This arrangement is getting into extensive introduction, and it is well worth the notice of any one designing a comparatively small mechanical workshop.

The speciality of Messrs. Shand and Mason has taught them a proper respect for fire. Accordingly they have a large water tank on the roof, with two descending mains. Fire cocks, with proper hose, are placed on every floor, ready for immediate use. Due precautions against fire are too often neglected in mechanical workshops. We believe that those fires often begin in the pattern shop, and generally during the night. In Messrs. Stephenson's works, at Newcastle, the night watchmen were formerly, and perhaps are yet, employed during the night in sweeping up the whole shop; clearing away all the wood shavings and iron and brass chips and turnings. The night watchmen were also obliged to register their wakefulness by means of a "tell-tale clock." The result of these precautions has shown itself very strongly. There never has been a fire in the Stephenson workshops. Messrs. Hawthorn's neighbouring establishment, where these precautions have not been adopted, has been burnt down, we believe, three times. Messrs. Stephenson's establishment is of longer date than that of the Messrs. Hawthorn.

The machine tools in Shand and Mason's shop are well chosen, but there are not many novelties for us to describe. We noticed a neat little tool for turning the round wooden handles for the hand fire-engines. This was made many years ago, by Mr. Tilley, and has been transported from the former premises occupied by the firm. A tubular spindle, worked direct by a pulley, is carried in bearings on a frame. The square strips of wood, out of which the handles are to be turned, are fed with a guide in front of the tube. As the wooden strip enters into the revolving tube, it is met by a knife, or cutter, fixed to a chuck on the tube, and the wooden strip is thus turned up in its progress along the tube. This arrangement evidently embodies the main idea of the well-known Kendall and Gent apparatus for cutting brass or other tubes into lengths.

One of Mr. Cater's boilers is used for feeding the condensing engine that drives the workshop tools. A scum-pipe, on Taplin's patent, is fitted to the boiler. The water supply for the condensing-engine, &c., is procured from a well, and there are two large tanks in the yard to give the full supply required for trying any large fire-engine. The nozzle of the fire-engine being tried is adjusted in a frame, and the water is made to play up a tall mast, 155 feet high, and stayed with galvanized iron rope. This mast is partly formed of one piece of wood, 96 feet long, from Vancouver's Island, having been imported in the same cargo as the well-known large spar in Kew Gardens. Messrs. Shand and Mason make the leather hose for their fire-engines, leather fire-buckets, and also fire-escapes—in fact, all kinds of fire apparatus. The leather piping is made in lengths of about 40 ft., jointed together out of shorter lengths of 4 ft., by 3-16ths of an inch turned copper rivets. In every 10 ft. there is a leather strap for carrying the piping when full. The spirals for the suction piping are made of half-round galvanized iron wire, ⅜ in. thick.

II.

Literature.

On Photo-zincography and other Photographic Processes employed at the Ordnance Survey Office, Southampton. By Captain A. DE C. SCOTT, R.E., under the direction of Colonel Sir HENRY JAMES, R.E., F.R.S., &c. London: Longman and Co.

THE rapid development of photography during the last few years, and its successful application to art and to a variety of purposes, tend to invest a study of its progress with extraordinary interest. So wide is the range of objects to which its marvellous powers have, in a comparatively brief period of time, been extended, and so constantly are its professors applying those powers to new branches of science, that it would be simply presumptuous to prognosticate when or where photography will find the boundary line of its influence. The Patent Office literally teems with specifications of improvements effected by photographic manipulators, and, apart from that office, innumerable discoveries of a like nature are recorded. The perseverance with which the subject has been studied and experimented upon, and the brilliant success which has rewarded students and experimenters, are cheering incentives to all who are engaged in the pursuit of scientific and practical knowledge. The publication of the work under notice is therefore opportune, and the care with which it has been edited is gratifying in the extreme.

We had long been aware of the adaptation of photography to the production of the smaller series of Ordnance maps, and, in fact, last year we gave our readers a brief description of the particular process which Captain Scott has now elaborately defined. To that gentleman's exposition of photo-zincography, Colonel James has added a preface, which contains some interesting information as to its origination. The Colonel states that "when, after several years of discussion, it was finally decided to adopt four scales for the plans of the National Survey, it became evident to me that, unless I was to introduce some system by which the reduction of the plans from 1-500th to the 1-2,500th scale, and from the 1-2,500th to the scale of 6 inches to one mile, and, again, from the 6-inch to the scale of 1-inch to the mile, could be effected more rapidly than by the pentagraph, or any then known method, the progress of the work of the survey would be much too slow and too expensive to be satisfactory to the country. I therefore tried some experiments when I was in Paris, in 1855, to ascertain whether photography could not be made applicable to the purposes."

Those experiments undoubtedly formed the basis upon which was eventually raised the superstructureof photo-zincography. It was not, however, until 1859, that any really practical progress was made with the work. "I was staying," says Sir Henry, "at Ryde, in the Isle of Wight, in the winter of 1859, when a lady asked me if I knew of any means by which she could get some etchings she had made copied and printed in an inexpensive manner. After some consideration, it struck me that the chromo-carbon process could cetainly be made applicable to this purpose; and on my return the next day to Southampton I brought one of the etchings with me, and had the chromo-carbon print taken, and transferred to zinc, the same day, and this was the first photo-zincograph ever taken here or elsewhere." It is not a little singular, nevertheless, that Mr. J. W. Osborne, of the Survey Office, Melbourne, Australia, was actually engaged almost at the same period in the development of a similar process. Mr. Osborne achieved success, and thus the discovery and application of the art was "therefore made perfectly independently at the opposite extremities of the earth." We believe, however, that no tangible recognition of Mr. Osborne's services in this direction was ever made by the Government—a fact by no means creditable to it. It has been stated that Captain Scott has gone very minutely and carefully into a description of the art of photo-zincography as practised at the Ordnance Works, Southampton. It is scarcely necessary for us, perhaps, to follow here that gentleman's example, because our excellent contemporary, the *Photographic Journal*, has travelled over the same ground and elucidated every point in connection with this remarkable process.

It would be very wrong were we to omit stating that the volume, which owes so much of its value to Captain Scott's labours and explanations, is handsomely appointed, and illustrated by a number of engravings produced by photo-zincography, and photo-lithography. One of the plates expressly demonstrates the capability of these sister processes for the multiplication, with delicate minuteness, of rare printed works—it is a copy of a page of the folio Shakspeare of 1623, a work in course of reproduction at the Ordnance-office, by permission of the War Department, and at the instance of Howard Staunton, Esq., of the *Illustrated London News*. Nothing can possibly exceed the fidelity with which, in this instance, all the quaint peculiarities of typography, punctuation, and orthography, visible in the original, are reflected in the copy. An examination of this specimen alone will serve to demonstrate the exceeding value of the processes to which it owes its origin. There is no room to doubt, indeed, that photo-zincography will be made to play a still more important part than it has as yet done in the reproduction, so to speak, of ancient monuments, paintings, and engravings. In the hands of Captain Scott, especially, whose knowledge of chemistry much assists him in the praiseworthy task, there is no doubt that this art will, in time, be developed to its fullest extent. The contribution to photographic literature, which has called forth the foregoing remarks, is one for the appearance of which all lovers of the art of photography have reason to be grateful, and our only regret is that we cannot devote to it more space in our own columns.

The Engineers', Millwrights', and Machinists' Practical Assistant. By WILLIAM TEMPLETON, author of "The Operative Mechanic's Workshop Companion." Second Edition. London, Lockwood and Co., 7, Stationers' Hall-court.

FEW men have done more real service to the mechanics of England than William Templeton. For many years past his handbooks on mechanical subjects have been the constant companions—always ready to communicate actual information — of the millwright and the engineer. The plain and simple way in which those works are arranged constitutes their main feature, and their most valuable characteristic. How often have we not seen the mechanic run to his tool-chest, and appeal to his "Templeton" therein carefully preserved, for information on some rather obscure point in connection with the work he had in hand, and return in a few minutes armed for the performance of his duty.

The name of the little work, which is the most recent emanation from the pen of Mr. Templeton, and which name heads this notice, is almost sufficient to convey a perfect idea of its character. Prefixed to the "Practical Assistant" is an arithmetical guide, which will be of service to those who are on the threshold of the engine factory, or machine shop, while those who are initiated into the art and mystery of engineering, or of millwright work, will find, further on, rules and instructions on which they may at all times rely, and which compass every branch of both professions.

With the utmost confidence, therefore, we stamp this book with the approbation of the MECHANICS' MAGAZINE, and, having done so, commend it to the attention of our readers.

The Practical Mechanics' Journal Record of the Exhibition of 1862.

WE should be not only ungenerous but unjust were we to withhold our congratulations from a respected contemporary upon the realization of a conception which was in itself admirable. The well-illustrated, and, of course, somewhat bulky volume, which is the result of the combined labours of a staff of scientific gentlemen, expressly engaged for its compilation, and which bears the above title, is not only a "record," but an abiding memorial of the International Exhibition of 1862. It is necessarily encyclopædic in its character, and it embodies a mass of information on all those sections of the great display which were of most interest to the scientific and practical members of the community. To attempt an analytical review of such a work is quite out of the question. The task would be Herculean, and we should be reproducing many matters which have already been dealt with in our own pages. Those who wish to possess in a compact and systematically arranged form a record of the Exhibition, cannot do better than place this volume on their library shelves.

A very carefully prepared, and, so far as we have traced it, correct *resumé* of previous industrial exhibitions, is given at the commencement of the volume, which ends with a vision of those of the future, from the able pen of Mr. Robt. Mallet, C.E.

The Builders' and Contractors' Price-book for 1863; with an Appendix of Tables, Notes, and Memoranda. Revised by GEORGE R. BURNELL, Civil Engineer and Architect. London: Lockwood and Co., 7, Stationers'-hall-court.

This well-known and, we may add, highly appreciated volume, needs but little commendation at our hands. It has achieved for itself the position of an authority in the matters of which it treats, and so long as it is edited in the same careful manner as at present, it will certainly maintain the distinction. The appendix to the work is likely to be of great service to practical builders, contractors, and general mechanicians, and the parallel of French and English scales of measurement which it contains is singularly valuable.

Apart from the classes to whom the *Price-book* is particularly addressed, there are, in these days of scientific progress, many persons to whom it would be found a useful companion. To all such we recommend it, knowing that it will, without our recommendation, find its way into the counting-houses and offices of its own especial audience.

Every Man's Own Lawyer: a Handy Book of the Principles of Law and Equity. By a BARRISTER. London: Lockwood and Co., Stationers' Hall-court.

IT may possibly seem rather extraordinary for us to notice a work with such a title as the above, but at all events we have much satisfaction in doing so. The world has not yet reached that happy period when the terrors of the law will not be required to deter from crime or wrong-doing. Doctor Cumming may tell us, if he can, *when* that "good time" will arrive, but meanwhile coarse and even violent expedients for the repression of vice must, we fear, occasionally be resorted to. In "Every Man's Own Lawyer" we have an epitome of the laws of Great Britain. The author seems to us to have employed his powers of condensation to immense advantage, and the result is a clearly-worded and explicit manual, containing information that must be useful, at some time or other, to everybody. Of course it will not enable a man in all cases to act as a lawyer, nor supersede the solicitor's mission, but we are bold enough to say that "Every Man's Own Lawyer" will save many a six-and-eightpence to its possessor, and teach him many things which he ought to know. It is really an admirable book of its kind.

INSTITUTION OF CIVIL ENGINEERS.

ON Tuesday week a meeting of the Institution of Civil Engineers was held; John Hawkshaw, Esq., President, in the chair.

The paper read was "On Railway Telegraphs, and the Application of Electricity to the Signalling and Working of Trains," by Mr. W. H. PREECE, Assoc. Inst. C. E.

In the two papers on "Railway Accidents," by Mr. Brunlees and Captain Galton, read at the institution during the last session, it was shown that twenty seven per cent. of the accidents arising from preventable causes were due to a want of the electric telegraph. No mention was then made of accidents attributable to the presence of the telegraph, of which several instances could be cited, and which had even led to an argument being maintained against its utility; but it was contended, experience had proved that, in particular localities, such as the Victoria Station (Pimlico), the New-street Station (Birmingham), the Lickey, and other steep inclines, and long tunnels, its employment was imperative. The author did not, however, advocate the general and indiscriminate adoption of the telegraph, as a primary power, in the working of railways. It was, like many mechanical arrangements, an uncertain agent, and its chief advantage lay in its secondary or auxiliary character, in which capacity it was invaluable.

The author then proceeded to discuss the various systems that had been introduced in working long tunnels, single lines, steep inclines, draw-bridges, and other exceptional cases; alluding incidentally to the supposed superiority of working lines by an interval of space in preference to an interval of time.

The first application was that of Mr. Cooke, the original introducer of the electric telegraph into practical use for railway and commercial purposes. He suggested and established on the Eastern Counties Railway, between Norwich and Yarmouth, in 1844, what was now known as the "block" system. A line of railway was divided into sections, each having its own telegraph, which regulated the line signals, and prevented the admission of a second train upon the same length of line. For this purpose a needle instrument was employed, which showed the presence of a train upon any particular section. The author pointed out that, by making the out-door signals a representation of the indications of the needle, distant stations could be worked like distant signals; and consequently, that instead of these signals being confined to distances of about 1,000 yards, by the aid of the telegraph the distance could be increased *ad infinitum*. Most railway companies, in working long tunnels, &c., employed simply a single needle speaking instrument, which, by a momentary deflection of the needle on one side, gave "train in," and on the other, "train out." Only these two signals were used on the entry and exit of trains. This plan was condemmed as being faulty and inefficient.

Mr. Edwin Clark (M. Inst. C.E) perfected the scheme of Mr. Cooke, in the system he introduced upon the London and North-Western Railway, which was fully described. The needle instrument was employed, but its indications were made permanent by the use of continuous currents of electricity. It not only showed when the line was clear, and when there was a train on the line, but also the occurrence of an accident. This last signal was produced by rupturing wires that descended every alternate pole on the line; but this plan was thought to be dangerous. The London and North-Western Railway Company did not strictly adhere to the "block" system. They allowed two, three, and sometimes four trains to be on the same length at the same time. The "train on line" signal was only accepted as a caution, and not as a danger signal. This was a partial expedient which provided a certain amount of safety, but it was not considered sufficient under all circumstances to prevent collision. A somewhat similar, but less complete, system was adopted on the Great Northern Railway; permanent signals were not used, but carefully kept record books were maintained in which all signals were entered.

The advantages and disadvantages of speaking telegraphs in connection with signalling apparatus were considered, and it was maintained that a speaking telegraph should never form a portion of a signalling system, but be a separate and independent agent. The objections to the needle instrument, as regarded its transitory signals, and its liability to reversal, demagnetization, and injury by lighting, as well as its capability of being converted into a conversational medium, were stated to be partially avoided in Mr. Tyer's, and in Mr. Bartholomew's systems. The former was used on the North London and several other lines; the latter on the London, Brighton, and South Coast Railway. Mr. Walker's system of bells, on the

South-Eastern line, by which an indicator was dispensed with, and dependence placed solely on sound, was mentioned. The French system of M. Regnault, which did not differ essentially from Mr. Clark's, excepting that the "block" was maintained by self-acting mechanism, and not by hand— a questionable alteration—was described. The French "appareils de demande de secours" and the German bell system were deemed to be impracticable in England.

It was shown that, in all these systems, the two signals, "danger" and "safety," were not sufficiently opposite in their indications to be unmistakeable, and that this was obviated in an instrument invented by Mr. Highton, in 1854, and recently applied on the Great Western line by Mr. Spagnoletti. Written words were given in place of the deflection of a needle. Moreover, the signals in all these systems were so dissimilar to those used out of doors, that the signalmen had to master and to retain on their mind two systems, the one line signals, to regulate those of the line. The author then proceeded to describe how he had assimilated, on the London and South-Western Railway, the electric to the line signals. The instrument used by him was an exact counterpart, on a small scale, of the signals employed on the line, whether semaphore, disc, or otherwise, and it was worked in a precisely similar manner. The electric signal was simply a distant signal; and it was contended that, if a system of signalling was found sufficient to work the trains by manual power, the same system must be equally efficient when manipulated by electrical agency.

The North-Western, Mr.Tyer's, and the South-Western systems—as embracing the principle of all those in use—were compared, and their relative superiority discussed. It was argued that, while the North-Western and the South-Western systems met nearly all the conditions laid down, Mr. Tyer's system failed to do so, and, under some circumstances, had been proved to be objectionable.

Various self-acting arrangements for communicating between two trains, or a train and a station, or signals and an engine, or signals and a station, &c., were alluded to, and their impracticability shown.

The danger of using the telegraph as a medium of conversation, without carefully writing down everything sent and received, and the necessity of repeating every important message, were adverted to. The use of record books, as a check upon the telegraph, was also advised.

The method of working single lines by telegraph was then discussed. This could be done in two ways, either in a primary manner, by means of a signalling apparatus, or in a secondary manner, to give notice of the delay of trains, to hurry on one train, to stop another, to alter the authorized passing places, and to prevent the unpunctuality of one train affecting all the rest. The system in use on the London and South-Western line, and in America, in which the latter plan was employed, was described. It was argued that single lines, properly worked, would be sufficient to meet a great portion of the traffic of this country; and that large sums of money had been uselessly expended, in consequence of Parliament compelling railway companies to make double lines, where a single line would have been ample for the requirements of the district. This had been owing to the absence of a reliable signalling apparatus, and the want of confidence in, or knowledge of, the telegraph by railway managers With a well-managed speaking telegraph to regulate the trains, and a reliable signalling apparatus to regulate the signals, safety and regularity were assured; and single lines might be worked as securely and as rapidly as double lines.

The low estimation in which the telegraph was held, and the consideration it received on the part of railway officials, were regretted; and while it was admitted that where indiscriminately used, the telegraph might become a positive source of danger, and yet when carefully applied it would be found to be the greatest element of security.

It was announced that the discussion, which had been commenced, would be continued at the next meeting, Tuesday, January 20th.—At the monthly ballot the following candidates were ballotted for and duly elected:—Messrs. J. W. Brassington, J. S. Crowley, E. Gotto, and G. Wilson, as associates.

MR. DONALD McKAY ON THE FRENCH NAVY.

MR. DONALD McKAY, who is now in Paris, has just communicated to the *Commercial Bulletin* (Boston) a very interesting account of the condition and size of the French navy,. The transformation of the French navy, says Mr. McKay, to armour-clad vessels, commenced in 1855, and it will be completed in 1870, when it will consist of forty first-class iron-cased frigates, with armaments varying from 36 to 52 guns each (all rifled and breach-loading), having engines of from 900 to 1,200-horse power, and all possessing a speed exceeding nine knots per hour. The naval estimate for 1863 amounts to 143,418,920f.—nearly 30,000,000 dols. The steam navy of France at present is composed of 325 vessels of all classes, and there are 42 building. There are 6 iron-cased frigates afloat, and ten building; and there are 14 iron-plated batteries afloat, and seven building; and there are 119 sailing vessels belonging to the navy. Mr. McKay states that, of the 16 iron-cased frigates afloat and in course of construction, only two are entirely of iron; and he says:—"It is now regretted by the Government that these two were not constructed of wood, for experience has already proved, and without any contradiction, that these vessels, on account of their bottoms fouling rapidly, will not be capable of keeping up in speed with the wooden-built and coppered frigates. The 'Warrior,' of the English fleet, has lost from this cause two knots of her original speed, and it is generally conceded that these iron-built men-of-war ships will have to be taken into dock at least every three months, to clean their bottoms." Mr. McKay alludes to the speed of the pirate "Alabama" exceeding any vessel in the American navy, and she is wooden-built and copper-bottomed.

The thickness of iron casing in the French frigates afloat, as well as those on the stocks, is 4¼ in. near the load line, and 4⅜ above. "Le Gloire," "Invincible," and "Normandie," are simply timber-built vessels cased with iron. They have attained a speed of 13¼ knots per hour under steam alone, with men and armament on board. They roll easily, are tight, steer well, and are efficient fighting ships. The ten new iron-clad frigates on the stocks are similar to "La Gloire" in outline, but they will carry their battery 14 in. higher. Their dimensions are—length, 265 ft.; breadth, 56 ft.; mean draft, 25½ ft. The iron-cased frigate, "Normandie," has made the voyage across the Atlantic, and is now at Vera Cruz. She has proved to be a good sea-vessel.

Several private establishments in France are fulfilling orders for the Government. M. Arman, at Bordeaux, is building two iron-cased floating batteries. They are to be covered with 6-inch plates, and armed with 180-pounder steel guns. At Nantes, M. Gouin is building two similar batteries, but their plates are only 4¾ in. in thickness. The whole dockyard organization in France is very perfect, and arrangements were lately made at Toulon and Cherbourg whereby provisions, &c., could be put on board of a fleet in half a day for an army of 60,000 men. All the naval constructions in the French service are allowed to submit their plans to a commission, and the plan offering the most advantages, though perhaps coming from the lowest rank, is accepted. Mr. McKay recommends this excellent system to the American Government. He asserts, that, in comparison with the French and English navies, that of America is not worthy of the name; and he recommends that twelve first-class iron-cased frigates be commenced without delay. He also recommends that no iron ships be built, but wooden ships covered with plating. He says:—"Iron ships ought not to be adopted in our sea-going fleet, for the following reasons:—

"1. The fouling of their bottoms (against which no remedy has been found yet), and consequent loss of speed.

"2. The weakness of their bottoms, and consequent liability of soon breaking up whenever they touch.

"3. The impossibility to give them a good ventilation, all the artificial means having failed to produce a good ventilation, on account of the many watertight bulkheads necessarily used in their construction.

"4. Their great unhealthiness, as proved already by the few cruises made by the 'Warrior' and 'Defence.'"

SMOKE-CONSUMING APPARATUS.

JUDGING by the oft-repeated appearance in the metropolitan Police Courts of the Smoke-nuisance Inspector, Mr. Sandison, the numerous fines exacted from manufacturers and others at his instance, and the line of defence almost invariably pursued on behalf of offenders, it might well be imagined that no effective apparatus for destroying opaque smoke had yet been invented. Such a supposition, too, would be amply justified at the east end of London by the long streams of dense and foul black smoke which may be seen in the day time pouring forth from many tall and short chimney stacks, and which sometimes darken and pollute the air of the entire neighbourhood. That means of consuming smoke, both effectually and economically, do exist is, nevertheless, a fact, and those who are mulcted of fines for not observing the provisions of the Smoke Nuisance Act, have themselves alone to blame for the annoyance. At one large manufactory, in the immediate vicinity of the unclassical, but bustling region of Whitechapel, where smoke nuisances prevail, there are, to our own knowledge, in constant use, no less than seventeen furnaces, each of which completely destroys its own smoke. The manufactory in which they are is the Royal Mint, and the kind of furnace employed is that known as "Jucke's patent."

We have examined these contrivances, and can confidently say that they are of the most satisfactory nature. They are on the endless chain principle, the links of the chain, so to speak, forming the fire-bars. By means of the simplest possible driving gear, the fire-bars are made to travel slowly forward, and, after depositing clinkers, &c., under a water bridge, which passes transversely over them at the inner extremity of the furnace, they turn round a disc, and return underneath. The thickness of fire on the bars is regulated by an adjustable iron apron in front, and the fuel consists exclusively of coal screenings. Such is briefly a description of the apparatus, the patent for which has long since expired. The fireman in attendance has nothing more to do than to fill a hopper with coal-dust, for it is little else, and then the furnace becomes self-feeding. It will be readily understood, from the above remarks, that a very small quantity of fresh fuel is continually being conveyed forward from the hopper, and that the smoke caused by its introduction is instantaneously consumed by contact with the living fire within. From the fact that the fire-bars, which are of cast-iron, have time to become cool in their lower passage, they last a very long time, and retain their square edges with astonishing precision.

It seems, indeed, to us that no better apparatus for its purpose than Jucke's Smoke-consuming Furnace need be desired. It accomplishes all that is asked for by the Smoke Nuisance Act. It is simple, and yet scientific; and, as the patent right has expired, its principle may be adopted by anybody or everybody.

We have not the slightest doubt that those who wish to see the Mint furnaces in action will be gratified on application to the authorities of that establishment; and we are sure that those who do see them will thank us for directing them to the spot.—*Building News.*

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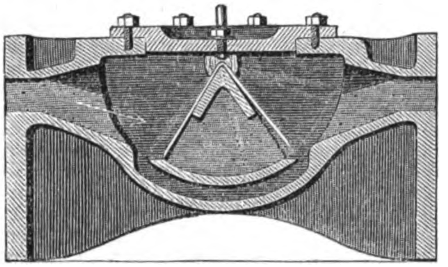
The "Industry," iron steam-vessel, after repairs, has had her keel coated with patent marine cement, and will receive stores for South America.

APPOLD'S VALVE FOR REGULATING THE DISCHARGE OF WATER.

THE accompanying engraving shows a valve for regulating the discharge of water and other fluids, just patented by Mr. J. G. Appold, of Finsbury.

This invention relates to a novel arrangement of automatic apparatus, whereby the rate of discharge of water, air, or other fluids, supplied at varying pressures, may be equalized or made nearly uniform. This result is obtained by mounting in a suitably-shaped chamber, through which the water or other fluid is passed, a swing valve, the movement of which (under the excess of pressure of the water), from its vertical position, will contract the discharge passage, and thereby limit the discharge of water. The regulating chamber, in which the swing valve is mounted, is formed with a segmental bottom, and the valve, which in end view is somewhat like a hollow wedge, is made segmental at its lower edge, proportioning it so that there is a free passage of water through the chamber, both below and at the sides of the valve. The ends of the chamber are of smaller radius than the bottom, and are pierced with longitudinal vertical openings, which are parallel for a certain distance, and then have a tapering contraction upwards. It will be understood that the water or other fluid entering the chamber at an undue pressure will force the valve out of its normal position, and cause it to rise up in front of the discharge opening, the height which it rises and the consequent amount of discharge opening thereby closed depending upon the pressure put on the valve. As, however, the pressure is reduced, the valve will return towards its normal position. In applying the apparatus to hydraulic lifts, for example, it is placed between the supply valve and the cylinder. This apparatus, when the inlet and outlet passages are made alike, admits of the water, air, or other fluid, being passed through in either direction indifferently.



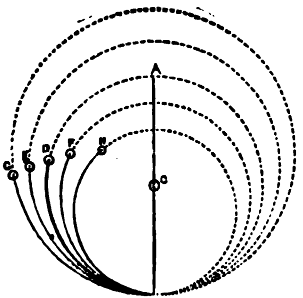
DENT'S AUXILIARY BALANCE.

THE following is a description of a new auxiliary balance invented by M. F. Dent, 33, Cockspur-street, London, and exhibited at the International Exhibition, 1862:—

By comparing a well made metallic thermometer with a mercurial one, we find that laminæ, composed of brass and steel, when properly made, bend regularly by regular changes in temperature, and that the rims of a balance, therefore, bend with regularity. As this is the case, an ordinary compensation balance possesses more compensative power in high than in low temperature; which can be proved in the following manner:—

In Fig. 1,[*] *a b* represents the arm of a balance; *c* the centre; and *b d* one of the compensation rims, standing circular with the centre in a middle temperature of 66 deg. If the end of that rim *b d*, by a change of temperature of a certain number of degrees above middle temperature, moved into *f*, it would, in the same number of degrees below middle temperature, move out to E for F B; and E B are of the same length as D B, when measured along the lines, and are parts of circles, of which one is as much larger as the other is smaller than the circumference of the balance in middle temperature. When the distance from the centre to F, D, and E is measured, it is found that a compensation weight placed on the rim, in moving from D to F, passes through a greater space, and approaches the centre of motion in a greater ratio than in moving from E to D, and, therefore, as the velocity with which a balance vibrates is in direct proportion to the distance of the weights from the centre, ordinary compensation balances must possess more compensative power in high than in low temperatures. It therefore appears, that the cause of chronometers going slower in extreme than in middle temperature is that pendulum springs, by regular increase in heat, lose strength in an increasing ratio, and in a greater proportion than the compensative power of the balance increases in the same temperature.

FIG. 1.

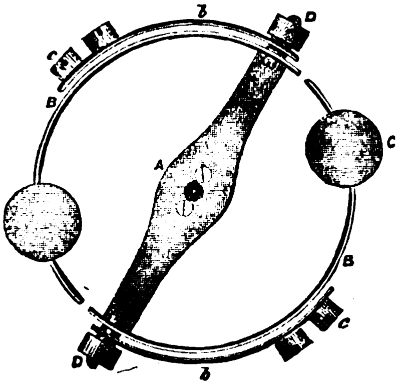


But, by again referring to the diagram, it will be seen that if the compensation rims, by the same changes of temperature, moved through a greater space—as, for example, from G to H—that that addition in the action from F to H would become larger than the addition from G to F; and, consequently, by causing the compensation weights to pass through a greater space, the compensative power of the balance is increased in high temperature.

This increase in the action of the new balance, invented by M. F. Dent, is obtained by making the compensation rims thinner. But, in adddition to this alteration, are fixed two other rims on the timing screw studs (see Fig. 2, D D). These rims have the brass inside and the steel outside, and are provided with a series of screw holes and heavy platina screws. As these rims expand in heat, and contract in cold, they not only counteract the too great effect on the compensation produced by the increased action of the primary rims, but, as they, like the primaryrims, act more when they are moving in, than when they are moving out, from their position in middle temperature, they likewise assist in making the chronometer to go faster in cold.

In Fig. 2, A is the arm of the balance; B B, the compensation rims; C C, the compensation weights; D D, the timing screws; B B, the auxiliary rims; and C C, the platina screws. These platina screws are placed nearer to the arm A, if the chronometer goes too fast in extreme temperature, and *vice versa.*

FIG. 2.



MR. WHITWORTH'S FLAT-FRONTED SHELLS.

THESE shells, that recently caused, both literally and figuratively, such a great commotion, have been made the subject of a patent by Mr. Whitworth. We extract the following from his specification, which has been lately filed, No. 1,663, dated June 2, 1862:—

Shells as heretofore constructed have not been fired in an entire condition through armour plates of any considerable thickness, such as the thick plates of iron now commonly applied to ships to protect them from injury from projectiles; they have always broken up upon impact, and when used as live shells the bursting charge has ignited prematurely. It has therefore been supposed that comparatively much thinner armour plates would suffice to exclude shells than would be required to keep out solid shot propelled with an equal charge of powder. Now, it has been found that one cause of the inefficiency of shells heretofore employed against armour plates has been that the concussion on a shell striking armour plates of any considerable thickness, and with velocity sufficient to penetrate it, generates so much heat as to explode the bursting charge in the shell, thus fracturing it before it has had time to pass through the armour plating. Another cause o the inefficiency of shells heretofore employed against armour plates has been, that the shells have been so weak that the force of blow has been sufficient to fracture them mechanically; this weakness has arisen usually from the materials of which the shells have been formed being soft or brittle, or both, and in many cases also from the form given to the shell. It is essential, in the construction of shells capable of being used efficiently against armour plates, that the fracture of the shell from the causes above mentioned should be prevented.

FIG. 2.

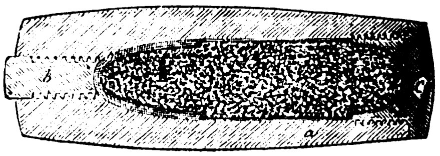
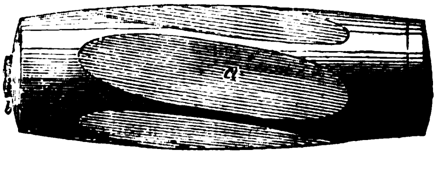


FIG. 1.



According to my invention shells are made of metal properly hardened. They are solid for a sufficient length in front of the internal cavity to give the requisite strength for penetration. The fuse usually employed for igniting the bursting charge is dispensed with, as the heat generated by the impact of the shell is sufficient to ignite the burning charge. To prevent the heat generated by impact from acting prematurely, and to regulate the time of ignition, the bursting charge is surrounded by a proper thickness of flannel, or other material which is a non-conductor of heat.

The shells are conveniently constructed of the form shown in Fig. 1 of the annexed engraving, this figure being a side view of the projectile; Fig. 2 is a longitudinal section of the same; *a*, *a*, is the body of the shell, which I make of the metal known as homogeneous iron, or of very mild lowly carbonized steel; the metal is by the makers of homogeneous iron cast into an ingot, and hammered so as to produce a bar of suitable section. Having obtained such a bar, forged approximately to the form of the shells, I cut it into lengths, each sufficient to form two shells; these lengths are then what is technically termed "converted," so as to render the exterior part more highly carbonized, and, therefore, harder than the interior, to a depth of from a quarter to half an inch. These pieces I divide, and bring to the form shown in the engraving, boring them internally, and turning and cutting them externally. This being done, I put the body of the shell into an iron box, and surround it with animal charcoal, cuttings of horn, and such like materials ordinarily employed in the process of case-hardening, and, as is usual in that process, I heat the box with the body of the shell within it to a red heat. I then withdraw it, still red hot, from the box, and having set it up on end, I cause numerous jets of cold water, by preference brine, to play both on its outer and inner surfaces, thus the shell body is rapidly cooled and rendered hard. In this state, however, it is more brittle than is desirable; this I obviate by tempering it, for which purpose I place it with its base on a block of metal, heated to dull redness, and allow it to remain there until a straw colour at the front and a blue colour at the rear indicate that it is tempered to the proper degree.

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[*] Fig. 1 is inaccurately carried out by a mistake of the engraver. The distances between the circles, of course, ought to be the same.—ED. *M. M.*

In Figs. 1 and 2, *b*, a plug employed to close the passage through the front of the shell; the object of forming this passage is to admit of the body being more thoroughly hardened than it could be were the shell made solid in front; this plug before being screwed into its place is also hardened and tempered. *c* is another metal plug screwed into the rear end of the shell, for closing it after the charge has been introduced. The interior of the shell may be painted or thinly covered with bitumen, marine glue, or other substances, such as are used for giving a smooth internal surface to common shells. The bursting charge, which may be powder, such as is commonly used for this purpose, is then introduced, being first enclosed in a flannel bag or case, in order to prevent the heat generated by impact from being transmitted too rapidly to the bursting charge, and at the fore part of the bag, as far, say, as the points marked x, x, several thicknesses of flannel are employed, the number of thicknesses of flannel used being more or less according to the effect it is desired to produce; the longer the time which it is desired should elapse between the perforation of the armour plate and explosion of the shell, the greater will be the number of thicknesses of flannel employed. In place of flannel, other materials which transmit heat slowly may be employed, but flannel is, I believe, most convenient. By these means I am able to make use of the heat generated on the impact of the shell with the armour plating, to fire the bursting charge, after the shell has penetrated through the plating.

The shells described may also be employed for penetration like solid shot, as by removing the centre part of the forged piece, which is sometimes unsound, I am able with great certainty to make the metal of the degree of hardness required, and which is varied, as described in different parts of the body of the shell.

I have found practically that a shell such as that shown, having a maximum diameter of 7 in., and propelled by 27 lbs. of powder, will, at a range of 800 yds., penetrate with facility a 5-inch wrought-iron plate supported by a heavy backing of timber and iron skin. It will be remarked that the shells shown in the engraving are flattened in front, and for penetrating armour-plates it is very desirable that this form should be given to them. Where the conditions are such that the shell can be made to strike with its axis perpendicular, or nearly so, to the armour-plating, a shell rounded in front may be be employed, although even under these conditions it will not penetrate with the same facility as a properly formed flat-ended projectile, but where the circumstances are such (as they would be in almost every practical case), that it is impossible to secure the shell striking with its axis perpendicular, or nearly so, to the surface of the armour-plating attacked, then a shell rounded in front is deflected on striking the armour plating, and either glances off entirely, or expends its momentum with more or less efficiency, according to the inclination at which it strikes. Shells with flat ends are effective if the object aimed at be below water. Shells constructed according to my invention, may, if desired, be fitted with ordinary fuses, and it is in some cases desirable so to fit them; they will not in this manner be rendered any more useful for employment against armour plating, for which they are primarily intended, but the fuses will enable them to be fired with effect, if necessary, at objects which will not offer resistance, so as to generate sufficient heat to fire the bursting charge within it, as for example, in attacking such a ship as the "Warrior," which is only partly protected with thick armour plate, the fuse would then insure the explosion of the projectile, which might not otherwise occur were the shell not to strike the thick armour plate.

It will be observed that, in the engraving, the shell is represented smaller at the flattened end than in the middle. This construction both assists its flight, and enables it to penetrate the more readily. The front of the shell, on striking, always produces a hole somewhat larger than itself, hence the body of the shell, notwithstanding its increased diameter, will be able to follow without experiencing much resistance. The taper in front should not be such that the inclined shoulder would deflect the shell on being fired through water, nor, in being fired through a plate, should its sides have to overcome lateral resistance. Again, the degree of convexity of the front must not be such as will prevent it from taking hold or biting into the inclined surface of a plate.

A parallel form would afford the greatest capacity for a bursting charge, and also a front that would most readily bite into a surface greatly inclined. The form which I find to be the best compromise for a penetration shell is that shown.

JEUNE'S SUBSTITUTE FOR LEATHER.

MR. W. R. JEUNE, of Bow, has patented a fabric to be used in lieu of leather for various purposes, which is described as follows:—

He takes a long sheet of fabric, felt, or paper, and spreads thereon a coating of india-rubber or gutta percha, or such like solution, and when the solvent of the solution is evaporated, a thin film of rubber or gutta percha is evenly deposited on the fabric, felt, or paper; he next applies a similar coating of india-rubber or gutta percha upon a number of skins or pieces of leather, and when the solvent is evaporated by the aid of iron rolls, he unites the skins or pieces of leather and fabric, felt, or paper, by passing them through the rolls with the rubber surfaces in contact. The fabric, felt, or paper, and skins or pieces of leather now united, are rolled upon a drum and placed upon a machine, in which, whilst the sheet is kept at the required tension, a knife, running at a quick speed, splits off as much of the skin or leather as may be required. The fabric, felt, or paper is now covered with a perfect sheet of leather; the remaining portion of the skins can again be treated in the same manner as before, so that the number of times he may split the skins depends upon the thickness of them, and the purposes for which the fabric is required. The precision of the splitting, which enables him to obtain several or many slices from the same skin or piece of leather, is only attained by the aid of the fabric, felt, or paper.

The fabric, felt, or paper, having a perfect surface of leather, may be dyed and embossed in the usual way, and a fabric is thus produced at a great reduction upon the price of solid leather, and which, as it contains a film of india-rubber or gutta percha, is waterproof, and therefore fit for many purposes for which leather would not be suitable.

When a waterproof fabric is not required, other cementing materials may be employed in place of india-rubber or gutta percha. He prefers, in producing the fabric above described, to employ not whole skins, but square pieces of leather, as these will fit together, so as to cover the whole surface of the fabric, felt, or paper, without waste, or the pieces of leather employed may be of other forms.

PEEL AND SIMPSON'S HYDRAULIC PRESSES.

A SERIES of very valuable improvements have been lately patented in the above class of machinery by Messrs. George Peel, jun., and J. Simpson, both of the Soho Foundry, Manchester. The Soho Foundry is, as well known, the oldest establishment of the kind in that city. Mr. Joseph Simpson is, we believe, the gentleman who, some years ago, brought out an "eccentric" shape of steam-engine that combined in a remarkable way all the usual defects of the rotary with most of the defects of the reciprocating engine.

These improvements in the construction of hydraulic presses, consist: 1st., in making the cylinders and rams of steel instead of cast-iron, as heretofore customary; in making the columns of steel instead of wrought iron; and in making the framing for the top and bottom of the press of wrought iron or steel, either alone or combined with cast iron or other materials, instead of entirely of cast iron, the object being to unite great strength with comparative lightness.

2nd. In the arrangement of hydraulic presses, in making the rams and cylinders to work within each other in the same manner as the slides of a telescope, the largest ram works within a stationary cylinder, and the smaller ram works within the larger ram, which acts as a cylinder; in this way two or more rams of different diameters may be acted upon successively to increase the power of the press as the speed diminishes. When the smaller or smallest ram has been raised, self-acting blocks come into action to support the follower, which is then carried forward by the action of the succeeding ram.

3rd. In working hydraulic presses by forcing the water that has been used to raise the ram or rams into an air vessel, in which it accumulates under pressure, and in conveying this water again into the cylinder or cylinders of the press for the purpose of partially raising the ram or rams during the next operation, by this means the rams are rapidly raised while the pressure to be overcome is small, thus economizing power and time in working the hydraulic press. The air vessel may be charged direct by the pumps when the pumps are not required for working the press.

4th. In arranging force pumps for hydraulic presses by connecting the plungers of two or more pumps to a beam working on a fulcrum; the piston rod of a steam cylinder is connected direct to one or both ends of the beam, thereby applying the power in the most convenient manner for working any convenient number of force pumps; the pumps are or may be of different diameters, and they are provided with self-acting valves, so that as the resistance increases, the larger pumps are successively thrown out of action.

We illustrate the second and third of these improvements.

Fig. 1 is an elevation of a hydraulic press, the cylinders of which work within each other. *a* is the lower or fixed cylinder, in which works the hollow ram *b*, which forms the cylinder for the second ram b^1; to the upper end of the ram b^1 is attached the follower *g*, to which are suspended the self-acting blocks *h*, *h*, the point of suspension of these blocks being so situated that the blocks when at liberty lean towards the ram b^1; to the upper end of the hollow ram *b* is attached the plate g^1. When this press is started, the rams and cylinders fit within each other as shown in Fig. 1, and the water under pressure is admitted into the hollow ram *b*, thereby raising the ram b^1 until it assumes the position shown in dotted lines; at this time the blocks *h*, *h*, catch on the plate g^1, to retain the parts in their proper position; the water under pressure from the hollow ram *b* then enters the cylinder *a*, and acts upon the hollow ram *b*, thereby raising it into the position shown; as soon as the follower *g* has attained the required elevation, a stop valve is closed, or the pumps stopped, and the whole is retained in this position, while the bale is being lashed or corded.

More than two rams and cylinders may be made to work into each other, like the slides of a telescope, as above described, for the purpose of increasing the power of the press in proportion to the increasing diameters of the rams on which the water under pressure acts. When it is desirable to restore the parts of the press into the positions shown in Fig. 1, the blocks *h* are moved apart by hand or by suitable mechanism, until they clear the centre portion of the follower g^1; the water in the hollow ram *b*, and in the cylinder *a*, is then allowed to return into the usual receiver from which the force pumps draw their supply, or the water is collected in the air vessel or hydraulic accumulator, shown on the elevation, Fig. 2. In this view, *i* is the air-vessel, fitting upon the stand *j*, the joint between the two being formed by the cup leather j^1; the water is admitted from the cylinders of the presses, above described, or from the cylinders of any other hydraulic presses, to the vessel *i*, through the inlet pipe *k*, screwed into the valve box k^1, in which is the valve *l*; this valve is raised by the water entering the air vessel, and is closed by its own gravity, or from the pressure in the air vessel; the valve *l* is a safety valve, the pressure on which is regulated by varying the position of the weight on the lever l^1, as usual; *m* is the outlet pipe for conveying the water from the air vessel *i* to the cylinder of the press, and the valve in the outlet pipe is opened and closed by a screw and handle or other convenient means. The mode of operation is as follows:—When the apparatus is first started the vessel *i* is full of air, and the communications between the inlet pipe *k*, and the cylinder of the press being opened, as soon as the water is turned off to release the pressure on the follower of the press, it is forced into the air vessel *i*, thus compressing the air within it; the water will continue to flow into the air vessel *i*, until the air within it is compressed to the same extent as the water issuing from the cylinder of the press; the valve *l* then becomes closed, and the rest of the water from the cylinder is carried off to the usual cistern. The water under pressure in the air vessel *i* is kept in reserve until it is again required in the cylinder or cylinders of the press for the purpose of partially raising the ram or rams during the next operation. The final compression must be given by the force pumps as usual; by this means the rams are rapidly raised while the pressure to be overcome is small, and a considerable economy of time and power is effected in working the press. The air vessel may be charged with water direct from the force pumps, when the pumps are not required for working the press, and that a series of air vessels in communication with each other, may be employed.

FIG. 1.

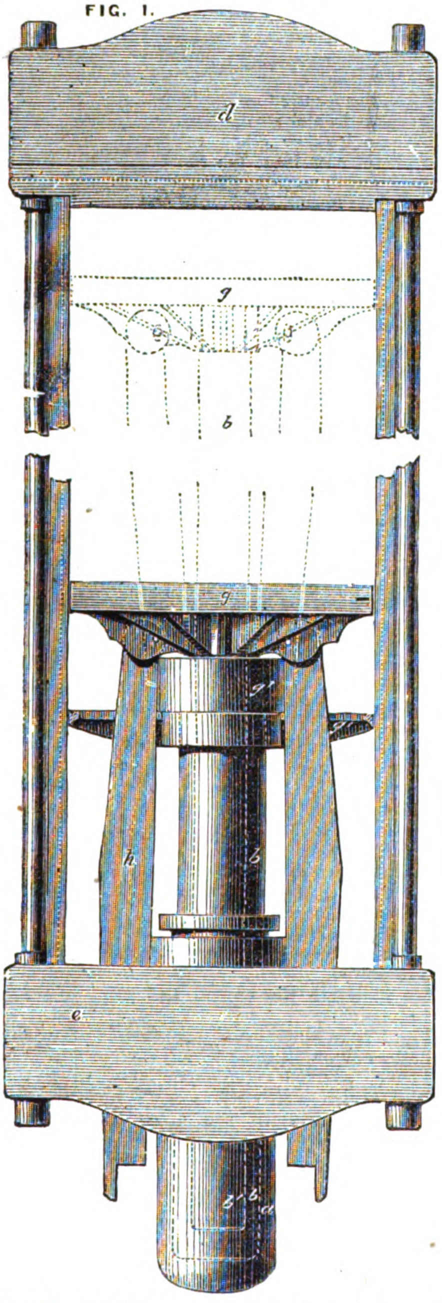
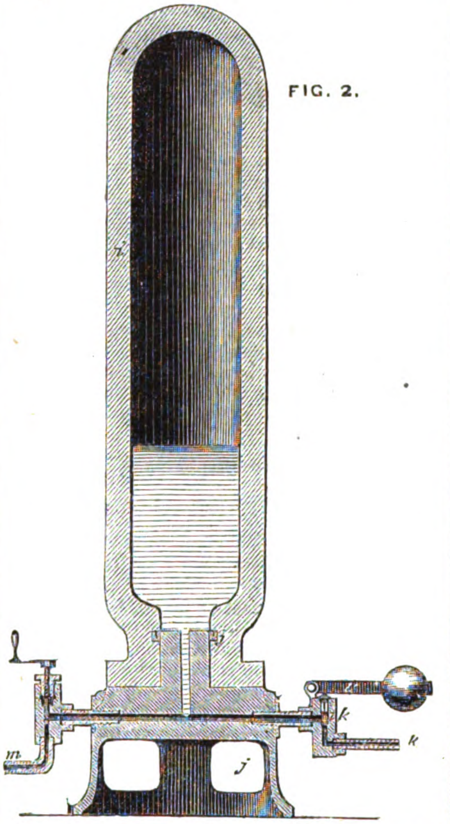


FIG. 2.



JOY'S IMPROVEMENTS IN FORGE HAMMERS.

THIS invention consists, first, in actuating hammers (hitherto driven directly by tappets, cranks, cams, or eccentrics,) by the intervention of a spring or elastic medium between such tappet, crank, cam, or eccentric, thus giving to the blow the character of elasticity; and to moderate the force of the blow, the elasticity is taken up by allowing the bar or block to work in a cylinder, or itself to be a cylinder, in which a piston is suspended, and admit air freely to such cylinder, or check it therein, thereby checking the blow due to the momentum of the hammer bar or block driven, as above described.

The second part of this invention has reference to steam hammers, and is supplemental to Mr. Joy's patent, dated the 1st of November, 1860, (No. 2,668), and consists in leaving out the valve, for the admission and exhaustion of steam, and in making the piston itself serve as a valve by allowing it to pass over and uncover a port or ports in the cylinder at proper intervals for the admission and exhaustion of steam; or reserve the action, and make the piston stationary, and allow the cylinder to move over it.

Figs. 1 and 2 are side and front elevations, with parts in section, of the first class of hammer, in which, however, india-rubber bands *e*, *e*, are used to transmit the motion of the crank or eccentric *c* to the hammer bar *a*, the cushioning of the blow being performed as before described. In both these, or any other such arrangement, the parts may be reversed, and the cylinder may be made to move while the piston is stationary.

Mr. Joy's new steam hammers are shown in Figs. 3, 4, and 5: *a* is the hammer-bar working in the cylinder *b*, which hammer-bar also serves as the valve. The steam is admitted at *c*, and the exhaust steam escapes at *d*. The upper part of the piston rod at a^1 is merely a pipe conveying steam into the body of the piston, or it may be fast to the cylinder lid and the piston slide upon it, being bored for that purpose. From this pipe the steam passes by the cross ports a^{11}, a^{11}, into cylinder by the open ports b^1, b^1, the same action taking place at the top or bottom of the cylinder accordingly as the piston is in either position. The exhaust escapes at *d* by the piston passing over that port upwards or downwards. The regulation of the speed or force of the blow is accomplished by the steam cock *h* and handle h^1. Fig. 3 is a longtitudinal section of the hammer so described; Fig. 4, a cross section vertically; Fig 5, a sectional plan at line Z Z.

Proceedings of Societies.

SCOTTISH SHIPBUILDERS' ASSOCIATION.

December 1, 1862.

JAMES RODGER, Esq., Vice-President, in the Chair.

Remarks on the Build and Equipment of Passenger Steam Vessels. By Mr. GEORGE BARBER, Shipwright Surveyor to the Board of Trade.

AFTER some introductory remarks, Mr. Barber said:—

Now, beginning with the HULL of the ship, I think that the most striking alteration, and I may say improvement, that has been made in the construction of merchant steam vessels within the last three years, is the introduction, in many of our large foreign-going steamers, of iron upper decks. They add considerably to the strength of the vessel, and a simple method has been discovered for preventing the cargo being damaged by the condensed vapour of the holds. For the safety, or, at any rate, for the comfort of those who have to work the vessels, I would prefer that where the deck is composed of ordinary smooth plates, there should be a light sheathing of wood; but it is a question whether, if, instead of doing this, it would not be better to use the plates which are rolled with checks, the checks being filled in with asphaltum or Portland cement; for I have not heard that any complaints have been made of the decks formed of this description of plate.

I believe that the IRON which is now generally used for ship-building is of a much better quality than that which was in use two or three years since. At that time it was considered or said to be almost impossible to get, for ship use, the *best* description of iron. The earnest and able articles which from time to time appeared in the various mechanical and scientific journals had, however, the effect of directing special attention to the subject. The experiments conducted by Lloyd's surveyors, and the report of those gentlemen to the committee, discovered and made notorious the fact that worthless, coarse-grained, badly integrated iron, was then much in use; and the recommendation with which the report closed, that makers of that description of iron and shipbuilders should be "warned of the discredit and mischievous results likely to fall on them through the use of such material," together with the regulation, so promptly

JOY'S TAPPET HAMMERS.

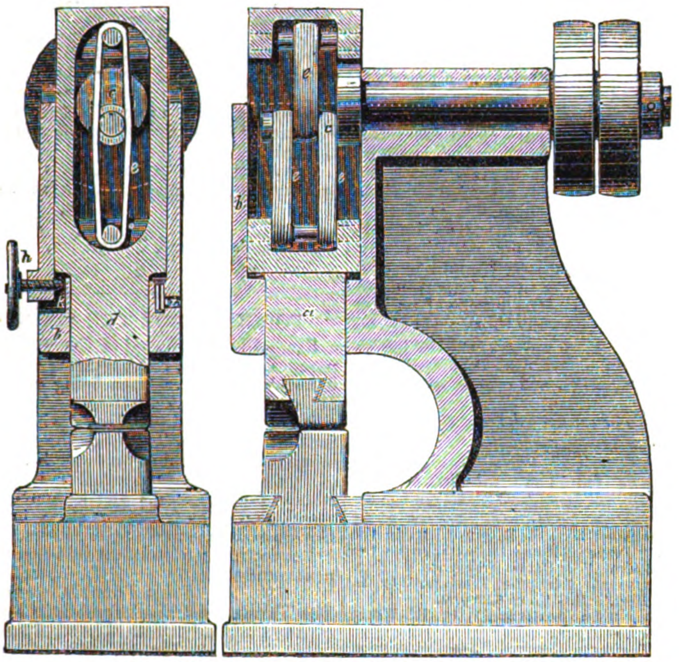


FIG. 2. FIG. 1.

JOY'S STEAM HAMMERS.

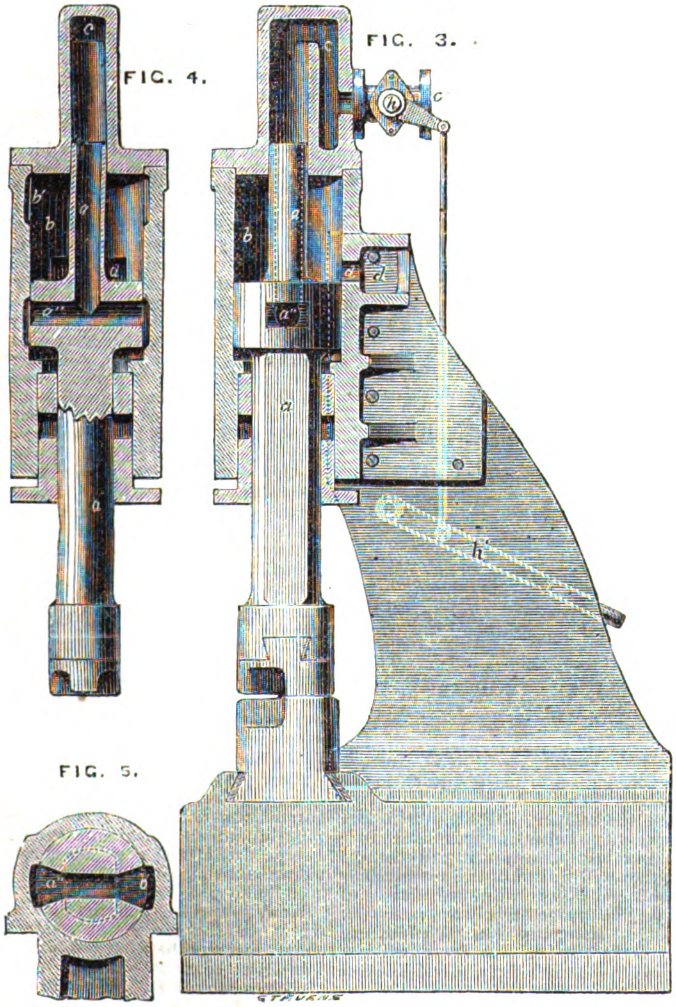


FIG. 4. FIG. 3. FIG. 5.

issued, that the maker's name should be stamped in two places on every plate, frame, and beam, used in the construction of vessels intended for classification, had the effect of arresting the progress of manufacture, for ship-building purposes at any rate, of such inferior material. At the same time Mr. Kirkaldy was conducting quietly, and with great care and patience, a series of experiments, the results obtained from which, together with the inferences deduced therefrom, have since been published, and form a most valuable book of reference. The numerous specimens of iron and steel upon which those experiments were conducted, and which it should be remembered were not manufactured specially for the purpose of experiment, but were selected promiscuously from engineers' and merchants' stores, are here beautifully arranged before us. An examination of them will, to those of us especially who have made ourselves acquainted with the tabulated results, be most interesting and instructive, and will prove, as conclusively as did the larger specimens at the late International Exhibition, that, even for ship-building purposes, iron of the very best quality can now be had from not a few of the iron manufacturers of this country.

Neither "homogenous metal" nor steel have yet been much used in ship building. It appears that corrosion takes place and progresses as rapidly upon these as upon common iron, and the advantages of comparative lightness and strength are, therefore, not alone sufficient to ensure the adoption of either of these kinds of material for the hull, although both have been found very suitable for masts and yards.

Ship builders are often blamed for not using the very best iron, but they are often blamed unjustly. It is absurd and unreasonable for an owner to bind a builder to the use of none other than the very best material, and the performance of the very best workmanship, while, at the same time, he is fully aware that the price beyond which he is not prepared to go is barely sufficient for the very worst material and the very worst description of workmanship. If owners would be a little more liberal, both as to price and to *time*, the result to themselves, to the builders, to the surveyors, and to the public, would be far more satisfactory.

You will remember that some two years ago I impressed upon you the importance of paying attention to the propér fitting of the butts in iron vessels, and I stated that I believed the practice of planing the butts, which obtained at some of the building yards at foreign ports would, before long, be universally adopted by the iron ship-builders of this country. I am glad to say, that at one at least of the building yards on the Clyde this improvement has been carried out. A short time since I was invited to examine, in the yard to which I refer, a large sailing ship which has just left the Clyde, and I was struck with the beautiful appearance of the butts; they fitted, or, to use a more expressive term, though one not so well understood on the Clyde, they *fayed* against each other most perfectly; no "bashing" of the butts and consequent punishment or destruction of the fibre of the iron had been necessary, and I was assured that the results of the introduction of the planing machine were so satisfactory, not only in the production of such excellent work, but also in the saving of time and labour, that another machine had been ordered for the same yard; and although "hand-made," butts have now reached a degree of perfection which a few years ago would have been considered wholly unnecessary, I feel persuaded that before long every builder on the Clyde will adopt this improvement, and that we shall never again see in new vessels, what I must admit is but rarely to be seen here—butts an eighth of an inch open, or caulked up with "slips."

It is also very gratifying to me to know that the suggestion that I made about the two stuffing-boxes aft has been acted upon, and I am confident that the vessels so fitted have an additional means of safety in the event of any accident happening to the stern-tube or its stuffing-box.

I have had my attention directed to the danger attending the arrangement which is sometimes carried out in ocean-going steamers, of allowing pipes connected with the machinery to pass through the ship's side in places where they cannot at all times be examined. Some pipes pass through the coal-bunkers, and can, therefore, be but seldom examined; by-and-bye, when the vessel is pitching and rolling in a heavy sea, the pipe, which perhaps has been eaten nearly through at its juncture with the ship's side, gives way, and before the defect can be remedied the coals have to be removed, while the vessel is all the time in danger of being filled. I am fully aware of the difficulties by which engineers are surrounded when arranging the pipes and cocks in a vessel; but if, in all cases such as I have described, a small recess were to be made in the bunker, just large enough for a man to get to examine the pipe, very little coal space would be lost, and an immense advantage in point of safety would be gained.

When I last addressed you, I stated that I believed you would all agree wlth me in thinking that an alteration of that section of the "Merchant Shipping Act," which referred to BULKHEADS, was absolutely necessary, and that, instead of requiring a vessel to be divided by two bulkheads into three compartments, it should require such a number of water-tight compartments, that, in the event of any one being injured, the vessel might be kept afloat by the buoyant capacity of the remainder. I presume that most, if not all, of you are by this time aware, that, instead of such an amendment having been made, the legislative interference with respect to bulkheads has been entirely withdrawn. By the "Merchant Shipping Act Amendment Act, 1862," the 300th section of the principal act is repealed, and builders and owners are now at liberty to decide for themselves the number, position, and thickness of bulkheads. In steam vessels, which will require to be surveyed for a passenger certificate, the Surveyor will not, as heretofore, exercise a supervision over the bulkheads, shaft-tunnel, &c., but he will have to satisfy himself that the vessel is sufficient — of sufficient strength and efficiently equipped — for the service for which she is intended. I mention this to you this evening because, from the questions which are being continually put to me by builders, it appears that this alteration in the act is but imperfectly understood. It seems to be thought that the news is too good to be true, though many builders and owners, who regard bulkheads as a means of safety, have assured me that all vessels built by or for them, shall be fitted with bulkheads and shaft-tunnel as efficiently as heretofore; and I trust that this will be the practice generally.

Within the last twelve months three or more sailing vessels have been built at this port of a combination of wood and iron, and one, if not two steam vessels of large size, are about to be constructed on the same principle. Being a disciple of the old wooden school, though almost a convert to iron, I very readily accepted the invitation of the builder to "take a look through" the first of these that was built, and I confess that, when I looked at the substantial teak bottom, the argument used by a master of one of the mail packets which I surveyed at Liverpool came forcibly to my recollection. The master was one of the old school, and the ship was one of the good old school —built by John Wood—with thick garboard strakes, or side keels, and filled in solid between the timbers as high as the light water-line. When I had completed my survey, the master said,—"Now, sir, you have been through this ship, and you have been through that new iron ship over yonder. You know what wood is, and you know what iron is, and I appeal to you whether I am not right when I maintain that it is against reason and common sense to suppose that what we have under our feet — seven inches of bottom plank, fifteen inches of floor timber, and five inches of ceiling caulked water-tight: twenty-seven inches of solid timber—is not better for a man to run at full speed upon the rocks with than three-quarters of an inch of iron plate?" I said, "Undoubtedly you are right, and I dare say you have a much greater feeling of security in this ship than you would have in the other; but you must remember that iron vessels are not built to run on the rocks." I cannot conceal from you that I have serious doubts respecting the efficiency of both the methods of carrying out this new principle of construction which have been adopted at this port, vastly superior as they are to the method which was first introduced; and I am disposed to believe that the theory of "iron to iron, wood to wood, all one or all the other," is correct; but at the same time I am bound to admit that every detail of construction, and every argument that could be brought againt it, appears to have had the most careful consideration; and I trust that the vessels will not only answer satisfactorily the object for which more especially they have been built, but that the expectations which the builders have formed respecting their mode of construction were realized.

One of your members whispered to me that he thought it very desirable that this association should conduct a series of experiments for the purpose of ascertaining the best preservative for iron ships' bottoms. I have been thinking over the matter, and it has struck me that if those members who have iron vessels trading to all parts of the world, and to those parts especially where fouling and corrosion of an iron bottom take place very rapidly, would give the results obtained from the use of the various compositions to which they have given a fair trial, the information would be very valuable. So many paints and varnishes and compositions come under my own observation, and I hear so many different opinions expressed upon each, that I find it very difficult to decide which is best. Parker's imperial black varnish has gained an excellent character; so has Peacock's paint and M'Innes' composition; the old-fashioned red-lead, provided it is good, sustains its reputation unsullied among its many rivals; and a coating of tallow upon red lead has been tried, as a preservative from fouling, and found to answer well. Mr. Grantham proposes to protect the bottoms of our iron men-of-war by the ordinary metal sheathing attached to a sheathing of wood, which is to be secured to the bottom by a method which he has described; and although several objections have been raised against his plan, he is deserving of great credit for having made so important a matter the object of his attention and study. Before I quit this subject, I would impress upon the owners who are present the importance of keeping the inside as well as the outside of an iron ship well coated; and not only those parts of the inside which can be easily got at, but the peaks, engine and boiler spaces, and coal-bunkers, should be carefully scraped, dried, and coated as often as possible.

(To be continued.)

Meetings for the Week.

MON.—*British Architects*, at 8 p.m.
Royal Geographical Soc., Sir R. Murchison in the chair. I. "Proposed Route to Siam, across the Isthmus of Kraw," by Capts. Fraser and Forling. II. "Visit to tho Island of Tsusinia," by L. Oliphant, Esq., F.R.G.S., at 8.30 p.m.
London Inst., "On Sculpture," by R. Westmacott, Esq., at 7 p.m.
TUES.—*Inst. Civil Engineers*, Renewed "Discussion upon Mr. Preece's Paper on Railway Telegraphs, and the Application of Electricity to the Signalling and Working of Trains," at 8 p.m.
Royal Inst., "On Animal Mechanics," by Prof. Marshall, at 7 p.m.
WED.—*Soc. of Arts*, "On the best means of establishing Electrical Communication between Great Britain and America," by T. A. Masey, Esq., at 8 p.m.
London Inst., "On Commercial Law," by G. W. Hastings, Esq., at 7 p.m.
THUR.—*Royal Inst.*, "On Chemical Affinity," by Dr Frankland, F.R.S., at 3 p.m.
Antiquaries, at 8.30 m. p.m.
Royal Soc., at 8.30 p.m.
FRI. — *Architectural Assoc.*, Class of Design, Gamekeepers' Lodge.
Royal Inst., "On Science and Art," by Cardinal Wiseman," at 8 p.m.
London Inst., "On the Chemistry of the Non-Metallic Elements," by F. Field, Esq., at 7 p.m.
SAT. — *Royal Inst.*, "On Life and Death," by W. S. Savory, Esq., at 3 p.m.

TO CORRESPONDENTS.

RECEIVED.—J. F., J. C., T. S. D., R. C. R., H. R. M., J. N., Directors Stevens' Bread-making Machinery, J. C.)next week), G. H. (next week), "A Reader (too late, a future number), "A Foreign Correspondent" (we do not understand you), J. M. (Bradford), want of space prevents us inserting your letter.

W. R. M. (Plymouth). You cannot *add* anything to the complete specification of a patent. A part or parts may be *disclaimed*. You will have to take out a fresh patent.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our Correspondents.*]

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ALLEGED LITERARY PIRACY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Mr. Potts having persuaded himself that he has taught Mr. Todhunter, his "Euclid," further claims to be the instructor of his publisher in the printing and get-up of the book.

I must decline the honour of having been Mr. Potts's pupil in this department, as I think Mr. Todhunter will in the other. If any one will compare the two books, they will find that the resemblance is as small as well could be between two editions of "Euclid" printed in type of nearly the same size. The diagrams, head lines, and general effect, are surely as different as can be. Mr. Potts's will not increase the glory he derives from his Exhibition medal by laying groundless claim to be the instructor of distinguished senior wranglers, or of a humble publisher.

I am, &c.,
ALEX. MACMILLAN.
Cambridge, Jan. 17, 1863.

SIR,—I have only just seen a copy of the letter written by Mr. Potts respecting myself, which was published lately in your Journal.

I wish to state distinctly that neither as student, teacher, or author, *have I ever made the slightest use of any of the works of Mr. Potts.* In my edition of "Euclid," I have given reference to the sources from which I have derived assistance in the manner of arranging the propositions in the notes and in the exercises; and I have not taken a single line, directly or indirectly, from Mr. Potts's editions, or from any edition of more recent date than his.

I need not recur to Mr. Lund's attack upon me, as I published an answer at the time.

I am, &c.,
J. TODHUNTER.
St. John's College, Cambridge,
Jan. 17, 1863.

FORGINGS FOR THE "MINATOUR."

SIR,—In your journal of the 9th inst. appears a paragraph, copied from the *Army and Navy Gazette*, describing the operations being carried on at the Millwall Iron Works.

It is there stated that the heaviest of the forgings for the "Minatour" building by this company are being manufactured at those works.

This statement is altogether incorrect, as the whole of the forgings and armour-plates for that vessel, as well as for other ships building by the Government, are made by ourselves.

Requesting you to insert this correction in your next number,
I am, &c.,
JOHN FORD, Managing Director.
The Thames Iron Works and Ship Building Company (Limited), Orchard-yard, Blackwall. E.,
Jan. 16, 1862.

GUNS AND PROJECTILES.

SIR,—It was with very great surprise that I read an article under the above title in the number for Jan. 9, of your magazine. My surprise, however, was lessened, when I came to the last passage, in which the writer says:—"We should not do justice to the ablest scientific writer on gunnery, Mr. Robert Mallet, C.E., F.R.S., if we did not acknowledge that we are indebted to his admirable essay on Artillery—exhibited at the International Exhibition, for some of the technical data above referred to; *but we hold ourselves responsible for the conclusions we have drawn from them.*" It is, therefore, evident that the article, although in prominent type, was a communication.

The MECHANICS' MAGAZINE has rendered public services to the country, by the able way in which the important questions of gunnery have been discussed in its pages. Such articles as the one to which I am now alluding, would certainly *not* have advanced the cause of truth. Passing over minor points for the present, we will remark, first of all, that the writer seems to intend that the gist of the article should lie in the following classification of the rival systems of rifling ordnance. Alluding to the five systems of: 1. Armstrong; 2. Blakely; 3. Whitworth; 4. Lancaster; 5. Lynall Thomas, the writer says:—"The five systems we will designate: 1. The narrow linear; 2. The broad deep groove; 3. The polygonal; 4. The oval bore; 5. The ribbed bore."

Pray what is Mr. Whitworth's polygonal, or rather hexagonal system of rifling, but *six* "broad deep grooves?" Describe a hexagon about a circle, and what do you get but *six* "broad deep grooves?"

4. "The oval bore."

Pray what is Mr. Lancaster's "oval bore," but *two* "broad deep grooves?" It is simply nonsense to say:—"The fourth is Mr. Lancaster's invention, which strictly is not rifling, but a modification in the cylindrical bore, which produces spiral motion without rifling!" A greater absurdity cannot be conceived than is contained in this assertion. A parallel sentence to this is the following:—"Accuracy of aim and maximum range, and velocity, irrespective of the powder charge, depend upon rifling and windage!"

5. "The ribbed bore."

Now, in a rifled gun, the shot may be called a screw, and the gun the nut. Mr. Lynall Thomas simply reverses the relative position of the thread. The writer seems to call Mr. Whitworth's system "the mechanical fit." Now *all* the *four* systems we have alluded to are "mechanical fits"—that is to say, the shots have to be prepared to fit the guns just in the same way as an engine-fitter fits a steam piston into a cylinder. In reference to the two first "systems," namely, "1. The narrow linear; 2. The deep broad groove," I should be glad to be informed as to the exact frontier line where the "narrow linear" ends, and the "deep broad groove" begins. The writer farther perpetrates the following:—"The narrow linear method, in the proper sense of the term, is *not* a system of rifling *per se.* It *is a medium for preventing windage* and *giving rotary motion to the projectile*, by covering it with a coating of soft metal, which, by compression, is forced into the narrow grooves." What is all rifling but "a medium for giving rotary motion to the projectile? How rifling can be called "a medium for preventing windage," I cannot see. A piece of hempen gasket wrapped round a shot can also be called "'a medium' (!) for preventing windage." We do not suppose, however, that the use of a piece of gasket could be called "a system of rifling?" "Rifling," however, in the brain of this writer, is a kind of universal "medium." We find him saying farther on:—

"Accuracy of aim *and velocity* are, more or less, dependent on rifling. The former, it may be said, absolutely—the latter, contingently; the powder charge here being the main cause." It is well known that rifling these matters actually *diminishes* the speed of the projectile. I wish that the writer's "*accuracy of aim*" had been greater and his "*velocity*" in jumping to a conclusion had been less in these matters.

There are several other blunders of commission and omission in this short article. I have confined myself to pointing out those which are demonstrable deviations from common sense and scientific accuracy.

It is evident that the writer is not an engineer. He must be one of those, who, forced by an adverse fate into the scientific arena, strive to hide the want of practical training and scientific knowledge, by enveloping themselves in a dust-cloud of long words.

The writer sapiently remarks:—"*So vague and unsatisfactory, however, are the notions prevalent on rifling*—so opposite to each other in principle are the systems and opinions of rival gun-makers and artillerists—that evidently the art of rifling is not yet understood, much less it is practised in accordance with scientific data, which admit of mathematical demonstration. *Nothing is true which cannot be demonstrated.*"

No better proof can be afforded of the truth of the first sentence than is contained in the article we are alluding to. In the last sentence the writer appears to assert that "*nothing is true which cannot be mathematically demonstrated.*" It is impossible to credit the writer of such trash with knowledge enough of algebra to square *(a + b)*, but does he not know that there is such a thing in the world as "physical demonstration?"

I am, &c.,
COSMOPOLITAN.

Chelsea, Jan. 13th, 1863.

[We insert this letter, though it disregards some of the amenities of journalism. The writer of the article may reply to "Cosmopolitan" should he deem it advisable.—ED. *M. M.*]

Gossip.

A leathern belt was lately manufactured at Pawtucket, R. I., for a Western woollen mill, which belt was 120 ft. (240 single) in length and 28 in. in width. It weighed 600 lbs.

Two great masses of copper recently discovered in the Mesnard district, Michigan, have excited considerable attention, as evidences of the inexhaustible and wonderfully productive nature of the Lake Superior copper region. Little of the first mass was above the surface when discovered and that little was so covered by moss and small underbrush as to hardly attract attention. Upon being uncovered, and the soil removed from around its sides, traces of Indian workings were found. Two pieces, one from each end, have been cut off the mass. Where it is cut through, the mass is pure copper, and very compact. The two pieces have been taken to the smelting works, and weighed 5¼ tons. The second mass found was still larger, measuring 40 feet in length and 4 in breadth. It weighed about 50 tons.

On Monday some interesting experiments, designed to show how a telegraphic apparatus can register simultaneously in type messages of which it is the medium, were made, in the presence of the Lord Mayor and other gentlemen, at the offices of the United Kingdom Telegraph Company, in Old Broad-street, where a machine for the purpose, as invented and patented by Professor Hughes, is now in operation, communicating with Birmingham and other large towns. The instrument was first introduced in America, and has since been brought into practical use in France, and more recently in Italy, with, it is said, complete success. It is now being tried on the lines of the United Kingdom Telegraph Company, with the view to its adoption by them. The machine is fixed to a table or platform not larger than an ordinary chessboard, and is altogether very neat and compact. The electric waves are transmitted by a revolving arm, which acts in concert with a type-wheel. On the face of the instrument are 28 keys, arranged like those of a piano, but occupying less than a third of the space. These correspond with an equal number of metal plates working upwards through slots formed all round a circular disc, on the top of which, but not in connection with it, the arm and what is called "contact-maker" revolve. The type-wheel and this arm revolve together, and when a key is depressed by the operator, a plate corresponding with the letter touched is raised and a letter is printed, while at the same instant, by a graduated movement, the paper is carried on a space ready to receive the next impression. The instrument is worked chiefly by women, and very much after the manner of a piano, but with a heavier touch. It prints at both ends of the wire simultaneously and in clear type, so that the operator sees the message which is being transmitted as it proceeds, and no copying or translation being required the chance of error it avoided. The speed secured in France and in America by highly-trained operators is said to have reached from 40 to 50 words a minute. At this rate, the instrument would print matter equal to a page of the MECHANICS' MAGAZINE, in a few minutes less than an hour, assuming there was no break in the operation, which probably would be too much to assume.

Arrangements are now being made at Shoeburyness for a complete trial of the 300-pounder muzzle-loading Armstrong gun, recently forwarded from the Royal Arsenal, and also for the official competitive trial between the Armstrong and Whitworth guns.

Last mail from India brought intelligence that the great iron floating dock, built at Sourabaya, Java, from the designs of Mr. R. W. Thomson, C.E., was successfully floated into deep water on the 23rd November. It was expected to be ready for lifting the largest ships by the end of the following month. Messrs. Randolph, Elder, and Co., of Glasgow, have just completed a similar iron floating dock for the French Government. This structure is capable of lifting out of the water the largest man-of-war in the world, not excepting the "Warrior," with all her guns and armour-plates in their places. This dock is also from the designs of Mr. Thomson.

The reconstruction of the brickwork of the arches and piers of the viaduct between the Bedford and Clapham roads on the metropolitan line (running from the Victoria Station at Pimlico to the Elephant and Castle at Newington) of the London, Chatham, and Dover Railway, which gave way some three weeks since, has been completed. On Monday morning the workmen commenced the ballasting of the road, and the operations will be continued with as little interruption as possible until completed, when the connection of the road being made, the line will be officially inspected. The works, so far as they have progressed, have been carried on under the immediate superintendence of Mr. Joseph Cubitt, C.E., the engineer in chief of the London, Chatham, and Dover Company, who, with Mr. Turner and Mr. Thomas, of the engineering staff, and Mr. J. S. Forbes, the general manager, and Mr. Bishop, the general superintendent of the line, has been in constant attendance on the spot. It is intended to reopen the line for public traffic on the 1st of next month.

The first of the second course of lectures arranged by the War Department to be delivered to the officers and men of the Royal Engineers, at the Royal Engineer Establishment, Chatham, was given on Tuesday evening by Mr. J. Anderson, on "The Mechanical Properties of Materials," in the Lecture-Theatre recently constructed. The order in which the lectures will be delivered during the season is as follows:—Jan. 22, on "The Construction and Maintenance of Telegraphic Lines," by Mr. Fleeming Jenkin; Jan. 27, "Choice and Preparation of Site for Military Buildings," by Professor Parkes, M.D.; Jan. 29, "The Construction and Maintenance of Telegraphic Lines," by Mr. Fleemin Jenkin; Feb. 3, "The Elementary Principles of Machinery," by Mr. J. Anderson; Feb. 5, "Arrangement of the Parts of Military Buildings, Sewerage," by Professor Parkes, M.D.; Feb. 10, 12, 17, and 19, "Hydraulic Engineering," by Mr. S. Roberts; Feb. 24, "Mechanical Power and its Application," by Mr. J. Anderson; Feb. 26, "Structures in Iron," by Mr. W. Pole, F.R.S.; March 3, "Steam and its Productions," by Mr. J. Anderson; March 5 and 12, "Structures in Iron," by Mr. W. Pole, F.R.S.; March 10, "The Steam Engine and its Application," by Mr. J. Anderson; March 17, "Iron and Steel Manufacture," by Mr. Anderson; March 19, 26, and April 2, "Pumping and Locomotive Engines," by Mr. W. Pole, F.R.S.; March 24, "Forging and Tempering," by Mr. J. Anderson; March 31, "The Art of Founding," by Mr. J. Anderson," April 7, "Tools and Machinery for Working Wood and Metal," by Mr. J. Anderson. A lecture on the solution of mechanical problems by geometrical construction, based on a work presented to the Royal Engineer Establishment by the Rev. Canon Moseley, is in course of preparation by Lieut. Fraser, Royal Engineers.

We are informed that Mr. Jas. Bruce has recently discovered a remedy for poisoning by strychnine and by mushrooms. It consists in making the patient eat large quantities of refined sugar, and in desperate cases opening a vein and injecting sugared water. Its effects are to oxygenate the blood and restore the circulation. He recommends its application to all venomous bites, and considers that it may be tried, with much advantage, in "lockjaw and accidents from chloroform." *Le sucre c'est le veritable ami des nerfs.* The effects of most poisons on the circulation are accurately determined microscopically in experiments with frogs, bees, flies, grasshoppers, ladybirds, snails, &c.; the pulsation of the heart being easily perceived.

The great iron floating dock built at Sourabaya, Java, from the designs of Mr. R. W. Thompson, C.E., was successfully floated into deep water on the 23rd of November last. The difficulties of launching such an immense structure were evaded by building it in a kind of dam made on the sea-shore. When the iron dock was completed the sea wall of the dam was broken down, and the sea rushing in lifted the dock from blocks on which it had been built. It was then towed out into deep water. It was intended to commence docking ships for repairs by the end of December last.

M. Revial has instituted a series of experiments at the Hôpital Lariboisière, Paris, and has shown the existence of a large amount of organic matter floating in the atmosphere. The dust of a ward was collected, and found to contain 36 per cent. of organic matter, chiefly in the form of epithelial cells. In the air of rooms containing the sufferers from contagious inflammation of the eyeball, small corpuscles were detected analogous to those of the virus thrown off from an inflamed eye. It is probable that infection, therefore, is mechanically conveyed from eye to eye by means of the air.

OIL OF ASPHALTUM FOR THE PRESERVATION OF BOILERS.—M. Dollfus reports to the *Societe Industrielle* of Mulhouse his success in using the heavy oil extracted by M. Lebel from the asphaltum and bitumen, at Pechelbronn. He says that it is perfectly successful and very economical as an unguent for heavy machinery. He applied it to the inner surface of his boilers and heaters by warming them so as to make the oil more fluid, and then applying it in a thin coat by means of a common broom. The results were very satisfactory; the calcareous crusts were gradually detached and the metal everywhere exposed. "I continue to use the oil whenever I clean a boiler, and I judge that the expense, which is about 10 kilos. (20lb.) for a boiler of 45-horse power, is largely compensated by the economy of fuel in consequence of the metal being clean: repairs are also much less frequent, as the boilers do not burn out so freely."—*Bulletin de la Societe Industrielle de Mulhouse.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 1837, 1839, 1849, 1852.
Boilers and Furnaces, 1820, 1859.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1814, 1838, 1856.
Ships and Boats, including their fittings, 1810, 1844.
Cultivation of the Soil, including agricultural implements and machines, 1845, 1862.
Food and Beverages, including apparatus for preparing food for men and animals, 1811.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1812, 1816, 1830, 1833, 1836, 1840, 1841, 1847, 1850, 1860, 1861.
Buildings and Building Materials, 1813, 1835, 1846.
Lighting, Heating, and Ventilating, 1815, 1853, 1863, 1865.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1817, 1824, 1842, 1848, 1855, 1858, 1864.
Metals, including apparatus for their mnufacture—*none.*
Chemistry and Photography—*none.*
Electrical Apparatus—*none.*
Warfare, 1829.
Letter-Press Printing—*none.*
Miscellaneous, 1818, 1819, 1821, 1822, 1823, 1825, 1826, 1827, 1831, 1832, 1834, 1843, 1851, 1854, 1857, 1866, 1867.

1810. M. Wigzell. *Improvements in the forms of bolts, and other fastenings, for ship building and other purposes.* Dated June 19, 1862.

This consists in the construction of a circular formed bolt, nail, spike, or pin, having one or more worms, ribs, or projections of such a form, and so placed in a spiral direction around its surface, as to cause the bolt, nail, spike, or pin to revolve whilst being driven into timber after a hole has been made the size of its solid or hollow circular centre. The bolt, nail, spike, or pin is driven home by a direct blow from a hammer, and will hold into the timber, or other substance into which it may be driven, with greater tenacity than the plain circular bolts now in use. *Patent completed.*

1811. E. J. Davis. *Improvements in treating and preparing food for horses and other animals.* Dated June 19, 1862.

For the purposes of this invention, hay, clover, and straw, either cut or uncut, and whether separate or mixed, also oats and other grain, either whole, bruised, or ground, are subjected to the action of free steam, the dried vegetable substances above-named being spread on reticulated trays, or other surfaces, so that the steam may pass freely amongst, and act on, every part of the same. Or in place of steam boiling water may in some cases be used; free steam is, however, preferred. *Patent completed.*

1812. J. B. Wood. *Improvements in the manufacture of driving straps or bands, the backs of wire cards and coptubes.* Dated June 19, 1862.

Here, for the manufacture of driving straps, &c., the patentee takes buffalo, or other untanned hides, cuts them into strips or shreds, and subjects the same to the action of certain acids. He next passes the strips or shreds of hide through fluted rollers, and subsequently through plain rollers, whereby the cuttings are converted into pulp. The pulp (with or without the admixture of cotton, flax, hair, &c.) is then passed between wooden or iron rollers, adjusted so as to produce any width or thickness of sheet that may be required. *Patent completed.*

1813. W. Thompson. *Improvements in machinery for making bricks, tiles, and other articles.* Dated June 19, 1862.

Here a pug mill is mounted in the centre of a base plate, and provision is made for the delivery of two streams of clay or brick earth through two openings at the opposite sides of the pug mill. The two streams of clay are received on two sets of rollers, and by them supported to two pairs of pressing rollers, from between each pair of which the clay or brick earth is forced through a suitable die in front of the rollers, and the stream of clay or brick earth thus moulded is cut by a suitable cutting wire or wires, as is well understood. Motion is transmitted from a steam engine or other power to the axis of the pug mill, and to the axes of the two pairs of pressing rollers in the following manner:—On the driving shaft which turns in suitable bearings under the bed plate is fixed a drum or pulley to receive the driving band of the steam engine or other power. On the other end of the driving shaft is fixed a pinion, which gears into and drives a cog wheel on another shaft, which is parallel to the driving shaft, and passes under the centre of the bottom of the pug mill. The pug mill shaft or axis passes through the bottom of the pug mill, and has fixed on it a bevelled toothed wheel, which gears into, and is driven by, a bevelled pinion placed on the shaft which is below the bottom of the pug mill; and on the same shaft are two chain wheels which give motion to two endless chains, one of which gives motion to a chain wheel fixed on the axis of the upper pressing roller of one pair, and the other endless chain gives motion to a chain wheel fixed on the axis of the lower pressing roller of the other pair, by which means, and by the axes of the pressing rollers of each pair being geared together, the two pairs of pressing rollers are caused to turn in the proper direction for receiving the streams of clay or brick earth, and forcing the same through the respective dies. *Patent abandoned.*

1814. W. Jeffries. *A new or improved rail for railways, and a new or improved chair or sleeper for the said rail.* Dated June 20, 1862.

This rail consists of a bar of wrought iron or steel, the upper part of which resembles the upper part of an ordinary rail, and the lower part consists of a shank or bar, the sides of which are parallel. The rail in cross section has a figure somewhat resembling the letter T, excepting that the top or upper part is thick and rounded like the head of an ordinary rail. The new chair or sleeper to be used with this rail is made as follows:—The chair or sleeper is made of rolled or cast-iron, and consists of two upright parallel plates or bars upon a base, the lower part of the before described rail fitting in the space between the two parallel plates. Cross bolts, pins, or cotters pass through the chair or sleeper rail and secure the rail in its place. Iron of the form described may be used in short lengths separated from each other after the manner of chairs, or in long continuous lengths, so as to constitute sleepers. *Patent abandoned.*

1815. J. A. Dupuch. *Improvements in cocks for regulating the supply of gas.* Dated June 20, 1862.

This relates to cocks for regulating the supply of gas from the street mains to the meter or burners, which improved cocks offer, to those hitherto made use of, the following advantages:—1, The cock's plug cannot be withdrawn from the barrel without the communication between the entrance and the exit openings for the gas being intercepted. 2, The plug cannot leave the barrel by the trepidations occasioned by heavy carriages passing through the street. 3. The plug always fits exactly into the barrel. 4. The cock is provided with arrangement for preventing, if required, the gas from passing through the cock. 5, This latter may be easily cleaned from the street. *Patent abandoned.*

1816. J. B. T. Detuncq. *Improved apparatus or machinery for treating flax or hemp.* Dated June 20, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1817. W. E. Gedge. *Improvements in the manufacture of candlesticks, and in machinery or apparatus used in such manufacture.* (A communication.) Dated June 20, 1862.

This consists in a method (the details of which we cannot quote here) of manufacturing candlesticks of sheet zinc instead of casting them as hitherto. *Patent abandoned.*

1818. J. Bedford. *A new or improved plane iron, cut iron, or double iron, and especially for the method of manufacturing plane irons and other tools by punching, flying, or stamping by dies.* (A communication.) Dated June 20, 1862.

The first part of this invention relates to a method of applying the cutting-iron so that it may be entirely used up. For this purpose, instead of fixing the steel cutter to the iron, the patentee secures it to the latter by a screw, and so renders it completely independent of the iron. This screw runs in a slot to allow of the cutter being shifted as it wears away, and to fix it in any desired position. The cutter, when fitted to the iron as above named, is furnished with a guard-plate above the cutter, and fitted so as to slide backwards and forwards with it when adjusting the latter. Thus it will be seen that the steel cutter fitted to the iron, as described, may be completely worn out, and another one substituted, without the plane being injured. The second part consists in the manufacture of the parts above described by cutting, punching, and shaping them in a lever or other press, either in a heated or cold state, so as to produce them readily in a polished state. The holes and slots in the plane irons and cutters are also made at the same time in one single operation. *Patent completed.*

1819. W. Malins. *An improved protective covering for agricultural or other similar purposes.* Dated June 20, 1862.

This consists in the use of sheets of plane or corrugated zinc, or galvanized zinc, or galvanized iron, in lieu of thatch or canvas as at present, the said metallic covering being formed, and firmly held together, by bolts and screws, through the medium of an adjustable framing. *Patent abandoned.*

1820. D. Adamson and Leigh. *Improvements in the construction of steam boilers, and in apparatus connected therewith, part of which is applicable to ship building.* Dated June 20, 1862.

This consists, 1, In drilling holes in the curved plates, forming part of steam boilers, by any convenient number of radiating drills acting simultaneously. 2, In combinations and arrangements of machinery for drilling several holes simultaneously through boiler plates. 3, In rolling flanges on the edge or edges of plates used in the construction of steam boilers, and for ship building, which flanges are secured together by rivets or welding. 4, In applying a system of perforated pipes to steam boilers for distributing the feed water, and in connecting the said pipes to a blow-off cock, for removing the sediment. *Patent completed.*

1821. B. M. Mody. *Improvements in varnish or polish.* Dated June 20, 1862.

This relates to the manufacture of varnish or polish, so that it can be applied by a camel's hair brush, either as a varnish to any smoothed surfaced wood, or, as a reviver to old French polished wood and furniture. The ingredients used the inventor proposes to mix in the following proportions:—Methylated spirit, 1 gallon; shellac, 1½ lbs.; gum benzoin, 1½ lbs.; dragon's blood, 6 drachms; or when a clear varnish is required the dragon's blood may be omitted. The ingredients when mixed are to be subjected to a gentle heat until thoroughly incorporated, and the mixture is then to be filtered in the ordinary way. *Patent abandoned.*

1822. J. W. Taylor. *Improvements in valves, and in means for regulating and indicating the flow and pressure of fluids.* Dated June 20, 1862.

These improvements in valves consist in forming the plugs thereof of india rubber, such plugs being secured by screw nuts or other means between flanges or washers to the spindle. For indicating the pressure of liquid, the patentee applies a small ram or piston in a cylinder, the lower end of which ram is pressed on by the fluid, whilst the upper end acts by links or connecting rods upon weighted levers, to raise the weight thereof as the pressure increases, and at the same time an axis with joints is set in motion to indicate the pressure exerted. The improvements relate, also, to means of regulating the flow of water obtained by condensation. For this purpose, he applies to a chamber used as a receiver of such water, an inlet passage with a valve (capable of closing the same), to which is applied a float adapted to open such valve with the rise of the water in such chamber, and admit of the escape of such water, whilst at other times the tendency is for the valve to be closed. *Patent completed.*

1823. D. Middleton. *Improvements in cranes for lifting weights into and out of carts, and for other purposes.* Dated June 20, 1862.

This invention was described and illustrated at page 34 of the last volume of this journal. *Patent abandoned.*

1824. C. Osman. *Improvements in the manufacture of elastic or yielding surfaces for sitting, lying, or reclining upon, part of which improvemenis are applicable to other purposes.* Dated June 20, 1862.

This consists, 1, in manufacturing elastic or yielding surfaces of vulcanized india rubber, made up and arranged in hollow or cellular forms, or so as to present the edges or ends of the india rubber towards the surface of the cushion, mattress, seat, or other surface, to which it is intended to give elasticity. 2, In forming elastic or yielding surfaces for sitting, lying, or reclining upon, from sheets, strips, or lengths of vulcanized india rubber, made up into twisted, spiral, corrugated, or undulating forms, arranged side by side, and secured in position so as to form the same into surfaces suitable for seats, cushions, &c. 3, In forming elastic or yielding surfaces for sitting, lying, or reclining upon, by connecting the upper or lower ends, or both, of a series of lever arms by strips or bands of vulcanized india rubber; or such lever arms may be connected together or retained in position by helical or other springs, so as to yield or give way when pressure is applied to the surfaces which they are arranged to support. 4, In forming or manufacturing corrugated or channelled surfaces of vulcanized india rubber, suitable for being applied to the construction of seats, cushions, or mattresses, for sitting or lying upon, such corrugated surfaces of india rubber being applicable for covering floors or walls, or for being applied to the soles of boots, shoes, or clogs. *Patent abandoned.*

1825. A. Warner. *Improvements in the manufacture of pigments or paints from certain refuse materials.* Dated June 20, 1862.

This invention has for its object the application of the refuse or slag obtained from puddling and re-heating or other furnaces used in the manufacture of pigments or paints. For this purpose the patentee takes the refuse or slag above referred to, and reduces the same to a fine powder by any of the well-known mechanical operations for grinding or pulverizing similar materials or other hard substances. The ground or pulverized materials are then to be washed or otherwise treated, and combined with oil or other materials, and used as pigments or paints for various purposes, as is well understood in the manufacture of pigments or paints from other oxides of iron or other metals. For the purpose of producing the slag or cinder to a fine or impalpable powder, the patentee prefers to use grinding apparatus, such as is used for grinding flints for pottery purposes, the materials being ground in water. After being sufficiently ground, the materials are run off into a tank and allowed to subside, and then the water is run off from the surface, and the wet, slimy mass is spread upon heated flues, or the material may be dried by other means. The pigment or substance thus prepared must then be taken and made up into paint by mixing with water or oil, and may be used in combination with colours and with dryers, according to the purpose for which it is required *Patent completed.*

1826. G. Gray and D. Cunningham. *Improvements in applying a new material to be used as a substitute for the blackening or other materials employed in casting or moulding metals.* Dated June 20, 1862.

The material used for the manufacture of this new kind of blackening or moulding material is the refuse product of bituminous shale, after this mineral has been distilled or otherwise treated so as to obtain the oil therefrom. The refuse matter of the shale is first dried by roasting, or other means, so as to render it fit for grinding; it is then ground in a suitable mill or triturating apparatus. The ground product is again dried, if necessary, and then sifted, so as to leave it in the form of a fine powder.—*Patent abandoned.*

1827. B. Fabricotti. *A polishing and grinding belt formed of leather or other flexible or pliable material, having plugs composed of emery or other gritty substance, and a proper cement inserted in it substantially.* (A communication.) Dated June 21, 1862.

The object here is to obtain a polishing belt which will retain its cutting, grinding, or polishing capacity until it is completely worn out, without requiring to be fed or supplied with emery, and to this end the patentee inserts in the belt, at suitable distances apart, plugs composed of emery or other gritty substance, and any suitable cement, the said plugs extending entirely through the belt, so as to form permanent polishing or cutting sorfaces.—*Patent completed.*

1829. F. U. Schneider and J. Snider. *Improvements in the construction of breech-loading firearms.* Dated June 21, 1862.

Provisional protection has not been allowed for this invention.

1830. J. Taylor. *An improved doffer or stripper for carding engines for preparing cotton and other fibrous substances.* Dated June 21, 1862.

This consists in the use of stripping blades arranged radially upon a cylinder or other axis, and rotating within a cylinder or shield containing apertures, through which the stripping blades project in succession only at such places as required for doffing, and retiring again, cleansing themselves of the cotton against the edges of the apertures in the cylinders. A modification of this doffer comb may be effected by arranging the blades upon a shaft passing through the shell of the cylinder, which is made hollow and of large diameter. Either may be actuated or driven distinctly, or in connection, that is, the blades may be made to drive the cylinder by contact. *Patent completed.*

1831. G. Simpson. *Improvements in machinery for working, boring, and mining or excavating tools, and mine and other pumps.* Dated June 21, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1832. H. Davenport and J. Davenport. *Improvements* *in means or apparatus for the manufacture of loom healds or harness.* Dated June 21, 1862.

This relates to the manufacture of loom healds, or harness, in which, in place of the nails, nooses are used, and the improvements have for their object to form knots to such nooses by the working of the mechanism employed in the manufacture of such healds or harness in place of such knots being produced by hand. For this purpose, according to one arrangement the patentees adopt, the threads or yarns of which the healds are produced, are conducted from bobbins lengthwise by the sides, and through the hollow end of an instrument, upon which the nooses are formed, and which serves to regulate their size. The yarns having passed out from this regulating instrument are acted upon by points or openers, and then by other points in pairs, which draw the yarn on each side of the flys or lappers for lapping on to the rig bands. Other instruments or forks then take back the yarns passing through the regulator, when pointers on each side take back such yarns, and from one of them fingers take one of the threads or yarns, and lap it over the other thread round the end of the regulator, where it is held by holders whilst the openers come into operation again. A forked slide on the fingers acts as a pusher to push the thread therein to the point of the fingers for the lapping in the proper place on the end of the regulator. A stop on the hollow end of the regulator prevents the thread being lapped on to from being drawn out of place by the lapping of the other thread. Varnish or other suitable adhesive matter applied to the knots will hold them in place when finished. *Patent completed.*

1833. J. Anderton. *Certain improvements applied to the tape-leg or sizeing machine, and in the apparatus employed therein for the purpose of improving the yarns.* Dated June 21, 1862.

Between the reed or snaith and the yarn beam the patentee places a box or trough for containing water or other liquid, and having bearings for carrying a circular brush, so that it can revolve in contact with the yarn by the passage of the yarn itself, or by other means. This arrangement is for giving moisture to the yarn, and thereby rendering it more suitable for weaving than is obtained by the ordinary machines. *Patent completed.*

1834. S. Holman. *Improvements in pumps and valves.* Dated June 21, 1862.

This relates, 1, to a novel arrangement of pump. The pump consists of a barrel or inner cylinder, made of iron or other material, placed within a cylindrical casing (which may be used as an air vessel), leaving a space all around between the inner and outer cylinder to permit the discharge of the fluid at or beyond each end of the barrel alternately. The piston, in its reciprocating motion to and fro in the barrel, operates upon the suction and delivery valves, so as to cause the water or other fluids to flow into and out of the pump, which ever way it is moved; it will thus be a double-action pump. In order to render this a cheap and efficient pump, the patentee prefers using valves made of india-rubber or other suitable material, specially arranged and constructed. The invention consists, 2, of new forms of pump valves and seats, viz., he purposes to make flexible valves of india rubber or other material in such forms and proportions as that each valve shall close an opening or space by a lateral or inclined bearing against the two sides forming the seating for the valve. 3, In the application of a double ring valve, made V form, similar to the double cap leather used in hydraulic presses, the inner ring forming the suction valve, and the outer ring the delivery valve, and operating upon seats adapted for them; or the outer ring may be made to form the suction valve, and the inner ring the delivery valve, according to the arrangement of the communicating passages. *Patent completed.*

1835. H. Gonnon. *Improved machinery for making bricks.* Dated June 21, 1862.

This machinery, which may be worked by steam, horse, or other power, is composed of a driving shaft with fly wheel; to this shaft is fitted two cams, one of which serves to raise a lever, and causes a hammer to strike the clay when it has fallen into the mould, and form it into a brick. The other cam serves to produce a movement which lifts the brick out of the mould. To this machine is adapted a kneader or crusher which prepares the clay. As the clay leaves the kneader or crusher it is cut by a knife into a size suitable to the mould used. After being struck by the hammer or mallet, it is pushed by a spring on to an apron which passes it to a board in a complete state. The shaft which carries the cams is set in motion by a wheel, and the entire machine is supported on a wooden or iron framing. By adding to or taking from the blades of the kneader, the bricks may be made of any thickness without change of mould. *Patent abandoned.*

1836. A. F. Maigron. *Improvements in winding off, carding, and spinning all thready fabrics.* Dated June 21, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1837. J. H. Redstone. *Improvements in the construction of boilers of steam engines.* (A communication). Dated June 21, 1862.

This boiler is composed of flues or tubes which hold the water to be heated in connection with the flue sheet, which is coiled in casting so as to form a series of tubes ranging vertically, and covering the whole face of the flue sheet or boiler head, or nearly so. In these tubes, in the flue sheet are perforations on the inside fitting the size of the flue, to allow it to be rivetted so as to make a steam joint. The tubes pass horizontally from one sheet or head to the other, and are rivetted or secured in the same manner as other flues or tubes in boilers. Outside, and opposite the end of the tube or flue, there is a perforation large enough to admit the tube or flue when one is to be replaced, as well as for rivetting the flue upon the inside perpendicular passage or tube forming part of the flue sheet. Across the top of the flue sheet, and connecting all the tops of the upright flues in the flue sheets, is a tube of increased capacity designed to connect the flues and serve as part of the steam space. These flue sheets are constructed with grooves and fillets fitting the sides and top of the frame-work to allow the expansion and contraction of the flues without straining them or loosening their connections with the flue sheets or heads. The whole frame-work is bolted together in the same way as a stove, the sides having a plate under the flue sheets to form the fire-box. The top is provided with a steam chest or space as follows:—Projections similar to tubes lying upon the lower surface, and leading to the centre of the plate (where there is a small chamber cast in the plate), are cored so as to form passages for the steam from the horizontal connecting tubes, which are arranged across the top of the upright tubes in the flue sheets, and by this arrangement, the flues and all the passages are accessible by simply removing the plug which closes the opening at the end of the flues or tubes. *Patent completed.*

1838. F. Tolhausen. *Improvements in apparatus for preventing collisions on railways.* (A communication). Dated June 21, 1862.

This consists of a rail jointed in the middle and at both ends, forming a double incline, placed by the side of the common rail at suitable distances on the line. This incline, or jointed rail, is kept up by balance-weights and springs, but when a train passes, it is depressed by a special wheel fixed on the locomotive or carriage axle. This depression causes a vertical rod to act on a bell-crank lever, at the end of which a wire or other equivalent link is attached, and the wire being thus pulled by the depression of the incline draws up a series of stops or projections placed at suitable intervals in advance of the moving train (600 yards, say). These stops are arranged similarly to knife blades, so as to open into a vertical position, and remain open when drawn or pushed one way, and shut when acted on the other way. Thus, supposing another train approaching in the opposite direction, a lever or fender placed on the locomotive of that train will strike against the stops and cause a bell on the locomotive to ring. There are other details. *Patent abandoned.*

1839. G. T. Bousfield. *Certain new and useful improvements in steam engine valves.* (A communication). Dated June 21, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1840. J. Lawson. *Improvements in the manufacture of carpets and other piled fabrics.* Dated June 21, 1862.

For the purposes of this invention, in producing a piled figured fabric, the patentee uses ground warp distended, as is usual between a warp beam and another beam or roller on which the fabric when finished is wound. This warp is arranged, by preference, in a vertical position, and is threaded through harness, by which it can be divided into sheds for the passage of a shuttle. For the pile yarn he employs as many beams as there are rows in the pattern, and he winds on each of these beams coloured yarns, the colours on each beam being arranged to succeed each other in the same order as they do in the row of the pattern to which the beam corresponds. Each of the pile yarn beams has attached to it a row of needles, and each pile yarn is threaded through the eye of a corresponding needle or short length of the yarn hanging down below the eye of the needle. When in the process of working it is desired to tie the pile yarn into the fabric, and produce with it a row of pile tufts corresponding with this row or line of the pattern, the pile yarn beam corresponding with this row or line is brought forward, and its needles are caused to pass through the warp carrying the ends of their pile yarns with them sufficiently far to be clear of the vertical warp; a shoot of weft is then thrown in, and, the needles having mooved back out of the way, the weft is beaten up upon the pile yarn which has been placed through the ground warp, as above described; then the needles of the same pile yarn beam are again passed through the ground warp, carrying loops of the pile yarn with them, and a pile wire is entered through these loops; afterwards another shoot of weft is thrown in, which, when the needles are withdrawn out of the way, is beaten up. A suitable cutting apparatus then divides the loops of pile yarn over the wire, and the pile beam in receding draws out the loose ends of pile yarn, leaving the loops in the fabric. The tufts to form the next row of the pattern are then similarly produced by another pile beam, and so on. *Patent completed.*

1841. E. Edmonds. *Improvements in the manufacture of felted articles, and fabrics, and in apparatus employed therein.* (A communication). Dated June 21, 1862.

This consists in combining with flat hardeners rollers or similar instruments for carrying forward through them a continuous sheet of fabric, and thus flat hardeners are enabled to operate on a sheet of any length, In order to produce better crossing and interlacing of the fibres of the wool, and a more even felt than has been before made, the sliver of wool from the scribber is not fed into the carder in the same direction as that in which it comes from the scribber (as heretofore in the manufacture of felted articles and fabrics), but transversely, or at angles to this direction. By this means the fibre of the wool, which, under the present system of making felted goods, proceeds longitudinally from one machine to the other, is reversed, and will better bear the action of the hardener. *Patent completed.*

1842. T. Wilson. *A new or improved dress-fastening, which said fastening is also applicable to the fastening of bands, and belts, and other like purposes.* Dated June 23, 1862.

This dress-fastening consists of two parts, one of which is fixed or sewn to one part of the article of dress, and the other to the other part of the article of dress. One of the parts consists of a flat piece of sheet metal, somewhat resembling a horse-shoe in form, that is, it consists of two parallel bars joined at one end by an arch or cross-piece. This part of the fastening has ears, or projections, in its outer edge, by which it is attached by sewing to the garment. These ears are near the free ends, and at the arch or cross-piece. All the parts of this part of the fastening are in the same plane. The other part of the fastening consists of a disc, or button, fixed to the article by its middle or otherwise. The button is inserted under the free ends of the horse-shoe shaped piece, and is passed between the parallel bars until it arrives at the curved junction of the said bars, when the connection of the two parts is complete. In separating the two parts, it is only necessary to press the button, or disc, with a simple pressure in a direction opposite to that by which it was connected with the other part, when it readily passes from under the other part. *Patent completed.*

1843. H. McKenzie and P. Ramsay. *Improvements in cylindrical or circular brushes, or rollers, for various manufacturing machines.* Dated June 23, 1862.

Here the object is to produce an improved cylindrical or circular surface, which, according to the velocity of rotation imparted to it, will have a brushing action or a frictional elastic adhesion, and which is susceptible of useful application in various manufacturing machines wherein rotating brushes or rollers are required. The improved surface is produced by fixing short pins, or projections of elastic rubber, either vulcanized or not, in the cylindrical or circular surface of the rotatory brush or roller, and this backing surface may consist of uncovered wood or other hard substance, or it may have a covering of elastic rubber or other light material, through which the rubber pins are made to project. *Patent abandoned.*

1844. H. Ponsonby. *Improvements in topsail sheets' bits or bolts.* Dated June 23, 1863.

This consists in the use of an apparatus made of iron, with pins, studs, eyelets, or other projections to which the respective sheets are made fast at either side, and which apparatus, by having its ends stepped in bushes, is free to make a partial revolution with the lower yard, under the slings of which the patentee prefers placing it in a vertical line.—*Patent completed.*

1845. G. Haseltine. *Improvements in machinery for mowing and reaping, the driving gear employed being applicable to machines for other purposes.* (A communication. Dated June 23, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1846. A. Webster. *Improvements in apparatus for boring slate.* Dated June 23, 1862.

This invention relates to certain improvements in the arrangement and construction of machinery for boring slate, more particularly in the form used for roofing purposes, so that each slate may be perforated at one or more places at a single operation, the perforations being much improved in form from those produced by the usual mode, and suited to receive countersunk-headed nails, whilst the loss from breakage of slates in boring is greatly reduced or wholly avoided. This invention consists, primarily, in applying a combined punching and drilling movement to the tools operating upon the slate, and shaping these tools and their matrices so as to produce countersunk or otherwise shaped holes. And, secondly, in certain arrangements of parts and mechanism for producing the necessary compound movement of the tools from a simple and intermittent hand action. *Patent completed.*

1847. W. Barr. *An improved manufacture of raised or brocaded fabrics woven in cotton or flux, either alone or in combination with wool.* Dated June 23, 1862.

This invention consists in making raised or brocaded fabrics, such as are or may be employed for under-garments, collars, trimmings, and other such like uses, and which require to be formed of a cotton, linen, cambric, muslin, or any other suitable material, or of any or all of such materials, in combination with wool, by weaving the same in a jacquard loom forming the pattern or brocade from the weft. *Patent completed.*

1848. R. Cook. *Improvements in the construction of pianoforte actions.* Dated June 23, 1862.

The chief object of this invention is to ensure the proper action of the "hopper," or instrument employed in pianoforte actions, to throw the hammer against the strings, and then suddenly to release it, that it may, after delivering a blow, instantly fall back to its quiescent position ready for repeating the operation. Hitherto the hopper, by reason of damp gaining access to that portion of its surface which comes in contact with the lever for transmitting the motion to the hammer, or to the hammer butt, has been very liable to stick, and produce what is called the blocking of the strings, thereby destroying the vibration. To avoid this defect, the patentee employs a metallic contact surface to work against the buff leather or other soft covering of the lever or hammer butt. *Patent completed.*

1849. A. Ripley. *Improvements in the construction of damper governors or regulators.* Dated June 24, 1862.

This invention relates to an improved method of regulating the draught in boiler and other flues. To effect this the patentee mounts on any convenient place adjacent, a cylinder having a piston or plunger and rod; from the bottom of the cylinder he leads a pipe connected with the boiler in the form of a double bond; this he fills with oil in quantity equal to the capacity of the cylinder when the piston is at the extreme stroke, and forces up the piston in the cylinder by this means. The oil serves to lubricate the piston and makes it work easy. The top of the connecting rod is attached to a long lever, one extremity of which acts upon a rod or chain connected with the damper, and the other end of the lever carries an adjustable weight to regulate the damper. The action is as follows:—The weight on the lever indicating, say, 40 lb. per square inch, the steam will have no effect upon the oil, and therefore on the piston, until it gets over that amount; the piston will then be raised, and the damper closed, and the generation of steam checked until the pressure is reduced; then the piston will descend and the damper will be opened. *Patent completed.*

1850. W. Hargreaves and G. H. Leather. *Improvements in machinery or apparatus for combing wool, hair, silk, cotton, flax, and other fibrous substances.* Dated June 24, 1862.

This invention relates to combing machinery, in which the material to be operated upon is drawn off in a continuous sliver of clean wool or other fibre, and also a continuous sliver of noil, dirt, and short fibre. The principle the patentees proceed upon is to mount a revolving dial comb, with its teeth or pins all pointing towards the centre on an iron framework, and within the dial comb they place a revolving roller or nipper, having grooves turned in it for the teeth or pins of the dial comb to travel in it. The circular nipper revolves upon its own axis, which is firmly fixed to a sliding frame, and this frame is acted upon by a spring and an adjusting screw, so as to press the revolving nipper against one side or the circular dial comb. When, therefore, the wool or other fibre is brought by the action of the machine to this point of the circular dial comb, it is by this revolving nipper firmly pressed into the pins and against the inner side of the comb, and whilst there the projecting end of the wool or other fibre is brought within the action of a porcupine card, or any other suitable instrument revolving at a greater velocity than the dial comb, whereby it is cleansed of its noil, dirt, and short fibre. The noil, dirt, and short fibre taken by the porcupine or card is passed from the porcupine by means of a revolving brush and cleansing card (or by any other well known means) in a sheet or sliver. By the further revolution of the dial comb the cleansed portion of the fibre is released from the action of the circular nipper, and passes under a set of stationary blades, to prevent the fibre from rising above the points of the teeth or pins of the comb, when it approaches a pair of ordinary drawing-off rollers, by means of which it is drawn off through the teeth of the dial combs. After passing by the drawing-off rollers, the portion of fibre left in the teeeh of the dial comb is brought by the further revolution of the comb to a set of stationary inclined blades, by means of which the fibre is raised clear out of the teeth or pins of the dial comb, and remains free from the teeth during a considerable portion of the revolution of the comb, and during this period is pushed forward by the face plate. By the further revolution of the dial comb the wool or other fibre becomes fixed in the teeth of the comb, and approaches the side of the comb against which the circular nipper is pressed, and its projecting end is there cleansed, as before described. The dial comb is fed or filled all round its circle of pins with the fibre to be operated upon, so that the different operations already described are continuously carried on, producing a continuous sliver of cleansed fibre, and a continuous sliver of noil, dirt, and short fibre. The face plate is made with a series of holes for the wool or other fibre to pass through to be operated upon by the dial comb. The creel has bobbins or cans to hold the wool or other fibre intended to be operated upon. Both the creel and face plate are fixed on one shaft, and geared to revolve at the same speed as the dial comb. The iron frame which carries the shaft of the creel and face plate is placed behind the dial comb, and can be adjusted to an angle with the dial comb, so as to give a greater or less length of fibre to be operated upon. *Patent completed.*

1851. T. Carr. *An improved machine for grinding, kneading, washing, and other like purposes.* Dated June 24, 1862.

This invention relates to those mills or machines known as edge-runners, and to that description in which the pan is rotated, and consists in driving or rotating on their axles one or both of the edge-runners, as well as the pan, but by a separate driving gear, so that the former acts independently of the latter, and a greater or less speed can, consequently, be given them than they would acquire from the mere rotation of the pan; while at the same time they are left as much at liberty as the ordinary edge-runners are to be freely raised by any substance they are unable to reduce passing below them, without stopping or injuring the machine. This invention also consists in suspending (in some cases) the stones or edge-runners, in such a manner that they are prevented from coming into immediate contact with the pan itself, or, when empty, of resting upon it, being so supported that they can be gradually raised or lowered at pleasure, so as to increase or diminish, as required, their proximity to the pan. The periphery of the edge-runners, or the surface of the pan, or both of them, may, when a more cutting action is required, be fluted or otherwise grooved or furrowed; or, instead, knife edges, spikes, teeth, or hooks may be inserted, as found most appropriate to the material to be treated. This invention further consists in the application, where required, of a lever or its mechanical equivalent, acting, by means of weights or springs on the said edge-runners, in such a manner as to be readily adjustable for the purpose of augmenting or lessening to any required degree the pressure on the material to be operated upon. *Patent completed.*

1852. T. Desgrandschamps. *A new mechanism of distribution with motion from the rod, applicable to any kind of steam-engines.* Dated June 24, 1862.

These improvements are applicable to all steam-engines, and offer the following advantages:—1, the slide valve opens very rapidly at each end of the length of the stroke of the piston, the opening of the inlet hole, or steam port, being nearly complete about the twentieth of the stroke, which, on the one hand, permits the steam to arrive, as it were, simultaneously behind the piston at the beginning of its stroke, and to act immediately with all its expansive force; and, on the other hand, permits this same steam, when it has pushed the piston to the end of its stroke, and thus completed its work, to escape freely without producing the back pressure which is the fault of existing distributors. 2, This distributor permits the steam to act by expansion at all points of the stroke of the piston at the will of the engineer, starting from the fourth of the stroke. 3, Certain pulleys, rods, eccentric rods, and other pieces, are replaced by a more simple apparatus, which may be kept in working order at less cost. The movement which works this distributing apparatus is taken from the connecting rod. This means is not new in itself, but in its application, which consists in transmitting the motion of the connecting rod to a slide, which forms the principal part of this invention, and which, by its particular arrangement and combination with the other parts of the mechanism constituting the distributing apparatus, forms a whole by which novel results are obtained, no distributor yet constructrd permitting the advance of the slide valve to be varied at will, and this is the principal property of the slide above mentioned. *Patent abandoned.*

1853. G. Collier and J. W. Crossley. *Improvements in means or apparatus for hot-pressing, which improvements are also applicable to other heating purposes.* Dated June 24, 1862.

This invention consists in making such press-plates of softer or more pliable metal, capable of being repeatedly cast in the same moulds, and the inventors employ, for the purpose, zinc, pewter, or a combination of these with lead, tin, or other metals, and they form the moulds of iron, or other hard or comparatively hard metal, or of plastic composition. They, by preference, cast the plates in parts, and of such form that, when soldered or otherwise fastened together, suitable hollow passages are left therein, for the proper circulation of the media used either for heating or cooling; and to prevent the expansion of the plates in the middle by reason of the internal pressure of the heating or cooling media, there are dovetailed or other projections in one part of the plate, which fit into corresponding recesses in another part of the plate. *Patent abandoned.*

1854. W. Bayliss. *An improved strainer for straining and tightening wire for fencing and other purposes.* Dated June 24, 1862.

This invention consists in setting up in a frame or stand a roller or pulley working through side supports, having a deep flange on one side, and an elastic packing on the other, secured on the extended axis of the roller or pulley in any convenient way. On the inside of the front flange a series of inclines are formed, which travel over a corresponding projecting incline formed on the face of the support, for preventing the roller or pulley from revolving but in one direction. The elastic packing on the outer end of the pulley or roller exerts its force in such manner that, as the pulley or roller is turned around, it will traverse parallel with its axis according to the rise and fall of the inclines, which, as the one in action passes over the termination of the incline on the support, the extreme ends of the inclines will be brought in radial contact, thereby preventing the roller turning in the reverse direction to the required strain. As for instance, in applying this simple apparatus to the straining of wire, the wire is first secured to the roller or pulley, and by placing the apparatus against a suitable abutment, the roller or pulley has to be turned with a fixed or portable winch handle, or other suitable means, and as it revolves, so the wire is held and strained to the desired tension, when it may be permanently secured in any suitable or ordinary way. *Patent abandoned.*

1855. J. Johnston. *Improvements in hats.* Dated June 24, 1862.

This invention relates to improvements in the manufacture of cloth hats, or those in which the bodies are covered with a woven fabric, in place of being formed of felt. Under one modification or system of manufacture the calico, or other similar material of which the body of the hat is formed, is prepared with shellac in the ordinary way. A piece of cloth, of a size suitable to form the under surface of the hat, is laid down, and upon this is laid a corresponding piece or sheet of the prepared calico, buckram, or other suitable material for forming the body. On the prepared upper side of the buckram is laid a piece of oiled cloth, paper, silk, or other suitable waterproof material. The whole of the fabrics are then lifted and laid upon a block, on which a secondary block or mould is caused to descend, and this block being heated, the several fabrics are caused to adhere by means of the intervening coatings of shellac. The hat so far completed, is now removed from the block, and the surface of the oil-skin or other waterproof material is coated with shellac in the ordinary manner. The piece of cloth which forms the outer covering of the hat Is now laid on, and this covering is caused to adhere to the body by submitting it to the blocking operation. The edges are then trimmed, bound, and the hat lined, which completes the manufacture, the hat produced being perfectly waterproof. *Patent abandoned.*

1856. G. Gray. *Improvements in the manufacture of wheels.* Dated June 24, 1862.

For the purposes of this invention, a peculiar construction of metal nave is used, by preference of cast iron. Each nave is cast in two parts, in one of which the several mortices or sockets for the inner ends of the spokes are formed, and such sockets or mortices are made by preference with parallel sides, the mortices radiating from the centre of the nave. It is preferred that the angular parts of the nave which come between the spokes, should be cast hollow, in order to obtain lightness. The second or outside part of the casting, simply consists of an outside cover to the nave, which is fixed to it by means of screws, the ends of which screw into an interposed disc or flat ring of wrought iron, and this disc or ring is fixed to the first mentioned part of the casting by means of screw bolts and nuts, the heads of which bolts are countersunk in the disc or ring, and the screw bolts pass through holes through the angular parts of the casting which come between the spokes. In putting a wheel together, the wrought iron disc or flat ring is put into its place, and so that it does not come in contact with the casting, but is held by moveable pieces a short distance away from it; the screw bolts are then passed through the ring and the casting, the nuts are then screwed up, and the ends of the wood spokes are driven into their places, the tenons being slightly taper. The flat ring or disc does not fit close around the cylindrical central part of the casting of the nave, against which the inner ends of the spokes come when they are driven home, and the fact of their being driven home will at once be seen through openings in the centre of the ring or disc. The spokes having been driven in their places, the outer plate is put into its place, and fixed by screws to the wrought iron disc; should the inner ends of the spokes shrink, the disc may be tightened by the nuts. *Patent abandoned.*

1857. E. C. Nicholson. *Improvements in the preparation of colouring matters applicable to dyeing and printing.* Dated June 24, 1862.

For the purpose of preparing a blue coal-tar dye soluble in water, either alone or mixed with acid or alkali, the patentee employs the following process:—He takes by preference the substance known as "Blue de Lyon," or that known as "Azaline," these being blue colouring matters obtained from aniline and similar bases. He extracts all soluble matter from it by boiling it with water containing sulphuric acid. He employs for this purpose the said acid in the proportion of about 4 oz. by weight to every gallon of water. When all or nearly all the soluble matter is extracted, he collects the insoluble matter and dries it thoroughly and completely. He then takes this substance reduced to powder, and adds to it about four times its weight of sulphuric acid, say, Sp Gr 1,845 (*i.e.*, concentrated sulphuric acid of commerce), and he raises the temperature of the mixture to about 300 degrees Fahrenheit, and keeps it stirred until all is dissolved; and he then maintains it at about this temperature until a sample when added to water is entirely dissolved. If the temperature is raised too high, sulphurous acid is evolved, and the dye gradually destroyed. The acid solution can be diluted and used for dyeing or printing in the ordinary way; or, if too acid, the excess of sulphuric acid may be removed by lime or other suitable alkali; or if an excess of lime be added, the sulphuric acid is entirely precipitated in the form of sulphate of lime, and a colourless solution is obtained which, when neutralized with any vegetable or other acid, developes the improved soluble blue dye; or he finds that the excess of acid may be separated from the acid solution by adding to it, say, four times its bulk of water, and then filtering, for the colour, although soluble in concentrated acid and also in water, is practically insoluble in water containing a large quantity of acid, or the slight loss of colouring matter which would arise from the use of water in this manner may be avoided by the use of brine in place thereof. *Patent completed.*

1858. W. Clark. *Improvements in hernial and other orthopedic apparatus, and in pessaries and other instruments.* (A communication). Dated June 24, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

1859. W. A. F. Mennons. *Improvements in steam-boiler furnaces.* Dated June 25, 1862.

This invention consists in the application to the fire-boxes of steam-boiler furnaces of an inner mantel or diaphragm, so arranged as to form a reverberating chamber, in which are effected the heating of the atmospheric air required for the combustion of the smoke, and its distribution over the ignited surface of the fuel in the grate. *Patent completed.*

1860. S. Brooks and S. Denton. *Improvements in machinery for spinning and doubling.* Dated June 25, 1862.

This invention is applicable to the copping motion of spinning and doubling machines, and it consists in an improved combination of parts for winding and binding the yarn on the spindles in the form of a cop, whereby more yarn is wound in each cop, and the cop is less liable to break or rove off than when the cops are built by the machinery now in use. In performing this invention the inventors make use of a short copping motion attached to the carriage of the mule or twiner; above the copping rail is a bowl jointed to the end of a lever, which vibrates on a fixed stud; to the stud of the bowl a link is jointed, which has a stud for another bowl on which the end of the faller leg connected to the faller shaft rests. By this means, as the copping rail gradually lowers in building the cop, the faller is gradually raised, and its position is governed so as to build the nose of the cop of the required shape. The second part of the invention consists in varying the position of the shaper plates by means of a screw tapped into one plate and passing through a projection on the other. The third part of the invention consists in regulating the number of teeth to be taken up by the rotchet wheel of the screw of the copping motion by a set screw passing through the lever, to which the catch of the ratchet wheel is jointed. The fourth part of the invention is applicable to mules having a long lever, as in Robert's self-actors, and it consists in an improved arrangement of parts for governing the long lever when the changes should take place. *Patent abandoned.*

1861. J. Blair. *Improvements in the manufacture of wadding.* Dated June 25, 1862.

This invention consists in the application, to the manufacture of wadding, of the fibres produced in tearing up the bags in which Surat and other cotton is generally imported into this country. This fabric is known as Surat tares, or Surat bagging, and it is made of a coarse fibre or grass, somewhat like jute. The fibres produced from this bagging the inventor now uses as a substitute for, or in combination with, cotton for manufacturing wadding, thus improving the quality, and economizing the production. *Patent abandoned.*

1862. W. Clark. *Improvements in ploughs.* (A communication.) Dated June 25, 1862.

Ploughs, as usually constructed, are formed of two principal parts – the "share," which penetrates the ground to a certain depth, and then raises it, and a "mould-board," which, immediately after the first operation, reverses the soil which has been thrown up by the share, so that the under part shall come to the surface, and *vice versa*, and so as to plough up the ground in furrows. These two principal parts of the plough, viz., the share and the mould-board, are fixed and rigid, the one stirring up the ground, and the other turning it over. This rigidity, which is the same in all ploughs, causes the ground to accumulate and clog in rising on the mould-board, which greatly increases the power necessary for turning it over, and requires the use of implements of great strength; at the same time it limits the depth of the furrows, and but imperfectly opens the ground. According to this invention, the inventor makes the mould-board moveable on an axis, fixed at any suitable part of the plough-frame. It is inclined in the direction of the furrow, so that, when the rotary mould-board receives the pressure of the ground thrown up by the plough-share, it is caused to turn, carrying with it the earth bearing on it, which it raises in its rotary movement, and turns it over so as to completely open the ground. This invention may be applied to all kinds of ploughs, whereby the mould-boards are made to rotate on an axis, and turn by the pressure of the ground as it is thrown up. The mouldboard, on rotating, carries the ground with it without difficulty, which, being thus opened up, the use of crushers or rollers may be dispensed with. *Patent completed.*

1863. G. Haseltine. *Improvements in vaporizing lamps.* Dated June 25, 1862.

The nature of this invention consists in mingling the vapour of coal oil with atmospheric air, either in a tube above the burner where the tube is exposed to an intense heat, and from which the combination descends to the burner, or in conducting the vapour after it is combined with air into a chamber above the frame, for the purpose of heating the mixture from which it descends to the burner. An elastic diaphragm, operated by a spring, is employed to force the fluid up from the body of the lamp into the upper end of the tube, where it is vaporized, and the vapour forced out through a minute aperture. A needle-shaped valve, operating within the said tube, is employed, the point of the needle being adapted to the said aperture operates in and through the same, and prevents the aperture from becoming clogged by condensed matter, and thereby obstructing the passage of gas or vapour. This needle is prolonged downward within the tube, or, what is the same thing practically, a small rod is connected with the needle, the said rod reaching to a point beyond the influence of the heat of the lamp, where it is connected with any suitable device for conveniently operating the needle to open and close the aperture, thereby regulating the flow of the gas. When this lamp or apparatus is used for cooking, and other domestic purposes, a heater is employed to vapourize the oil. *Patent abandoned.*

1864. F. Tolhausen. *Improvements in locks or locking apparatus.* (A communication). Dated June 25, 1862.

This improved lock or locking apparatus consists of a bolt or bar which is lodged horizontally either in the lid or the body part of the trunk or box, and is acted upon by coiled springs so as to shoot forth and enter one or more eyes or hooks attached to either part of the trunk, when these two parts are brought home together. The said closing bolt may be constructed in various ways; it may have several hooks, which are intended to enter the eyes on the other part of the trunk. The closing bolt, whatever may be its shape, is entirely contained in the trunk, and the aperture by which access is had to it is covered with a button, or any other ornamental device. For the purpose of unlocking, the bolt is either screwed, tapped, or otherwise shaped at one of its ends, so as to allow inserting a special tapped, screwed, or other key, by which the bolt is drawn or shifted, and the eyes or staples released, when an obstructing piece, acted on by a spring, rises to keep the bolt out and ready to act on closing the lid again. *Patent abandoned.*

1865. A. Bayley. *Improvements in lamps.* Dated June 25, 1862.

The object of this invention, which relates principally, but not exclusively, to those lamps for burning paraffin, rock, and other spirit oils, is, 1, To dispense with the glass chimney or globe usually employed, and yet to supply a sufficient quantity of atmospheric air to maintain steady combustion, by simply lighting the lamp, but without the use of any mechanical motion. Over the liquid container of the lamp, which the inventor prefers making of a semi-spherical or conical shape, or over a cap of similar or other suitable form, secured above the liquid container, but fitting air-tight to or around the wick tube, he fits a cap, having the same general outline, and by fenders, or other arrangements, keeps it a distance from the liquid container or cap first mentioned, thus leaving a truncated space for the supply or ascension of air to the point of combustion. The distance between this outer cap and the inner one, or liquid container, is greater at the bottom or air entrance than at the top, towards which latter it gradually diminishes, and where the air, having become heated in its passage through the said truncated space, finally commingles with the vapours from the wick, and impinges on the flame, thus supporting a bright and uniform light. 2, To supply a sufficient and uniform quantity of air to lamps having chimneys or globes. To effect this he employs the air supply arrangement first hereinbefore described, and fixes a gallery or carrier on the outer cap, either so constructed that when the chimney or globe is held in position it will entirely exclude the air, or by leaving small openings it will admit a sufficient air supply to make perfect combustion of the oil used. *Patent abandoned.*

1866. C. C. Steenstrup. *An improved can or vessel for containing lubricating or other fluids.* Dated June 25, 1862.

This invention consists in constructing a can or vessel, principally intended for lubricating purposes, in such a manner that the oil or other lubricating fluid contained therein is ejected from the same in determined quantities, and with a certain force, which may be regulated at the pleasure of the manipulator. For this purpose the inventor fixes inside the can or vessel a small cylinder or pump barrel, which has one aperture through which it communicates with the interior of the can, and a second aperture through which it communicates with the spout of the can to which it is attached. Both apertures are closed by valves; that to the first named aperture opening inwards, similar to the suction valve of an ordinary pump, whilst that to the last named aperture opens outwards, similar to the delivery valve of a force pump, and both these valves are pressed down on their seats by means of small springs. Beyond both the above-named apertures is a piston capable of being worked up and down inside the cylinder to a variable extent by means of a piston-rod passing out to the outside of the can or vessel, where it is provided with a knob or disc which is depressed by the hand. A spring pressing against the under side of this knob forces the piston rod, and with it the piston back into a certain position after it has been depressed by the manipulator, and maintains it in this position when it is not acted upon. Projecting from the outside of the can or vessel by the side of the piston rod is a graduated scale, the divisions upon which indicate the distances to which the piston must be depressed for a certain number of drops of oil or other fluid to be ejected from the spout of the can or vessel. *Patent abandoned.*

1867. E. H. Heech and J. F. Windhausen. *Improvements in caloric engines.* Dated June 25. 1862.

The specification of this invention comprises a great amount of detail, but the main feature of the invention is the use of compressed air, mixed with gases or products of combustion, for driving the engines constructed as described. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Sept. 1, 1862.

2422. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the manufacture of braid, and in machinery or apparatus employed therein. (A communication.)

Dated Sept. 20, 1862.

2581. B. Hotchkiss, New Haven, United States. Atmospheric trip hammers.

Dated Oct. 17, 1862.

2804. H. Wickens, 4, Tokenhouse-yard, solicitor. Improvements in machinery for making nails. (Partly a communication.)

Dated Nov. 1, 1862.

2959. W. E. Newton, 66, Chancery-lane, civil engineer. Improved apparatus for drying grain and other substances. (A communication.)

Dated Nov. 10, 1862.

3027. J. B. Savoine, St. Pierre, near Calais, architect. A kitchen range adapted for cooking, warming the apartments, and generating gas for the use of private families, hotels, or gentlemen's country seats.

Dated Nov. 29, 1862.

3203. T. Evans, Cross-street, Abergavenny, boot and shoe manufacturer. Improvements in coverings for the leg and thigh known as antigrophilos.

Dated Dec. 8, 1862.

3291. J. Hilliar, Balsall-heath, manager of works. Improvements in ventilating, and in the exclusion of dust or draught, insects, or other animals from apartments, carriages, or other confined spaces.

Dated Dec. 10, 1862.

3312. A. P. Price, Lincoln's-inn-fields, consulting chemist. Improvements in the manufacture or production of blue colours. (A communication.)

3813. D. Chalmers, Dundee. machinist. Improvements in the preparation or manufacture of textile materials, and in the machinery or apparatus used therein.

Dated Dec. 17, 1862.

3374. T. C. Barraclough, Manchester, machine agent. Improvements in machinery for spinning, twisting, and rolling tobacco. (A communication.)

Dated Dec. 22, 1862.

3411. F. C. Bakewell, 6, Haverstock-terrace, Hampstead. Improvements in transmitting and receiving communications by means of electricity.

Dated Dec. 23, 1862.

3421. C. Pieper, Alma-place, West Gorton, near Manchester, engineer. A new improved governor for steam engines, turbines, water wheels, and other machinery with valvular arrangements, to regulate the speed of the same.

3428. J. Whitley and J. W. Burton, Leeds. Improvements in the construction of the permanent way of railways, which improvements are also applicable to railway wheels.

Dated Dec. 24, 1862.

3431. S. Haslam, Bolton, warper, and A. Eatough, carder. Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.

3433. J. Broadbent, Manchester, and J. Robinson, Latchford, Warrington, cotton spinners. Improvements in machinery for opening and cleaning cotton and other fibrous materials.

3435. A. P. Tronchon, 2, Rue Sainte Appoline, Paris. Some improvements in the construction of fire arms.

3437. W. C. Galloway, Glasgow, pianoforte teacher. Improvements in pianofortes.

3438. W. Henderson, St. Rollox, Glasgow, chemist. Improvements in obtaining iron and steel from certain ores and residual products.

3439. W. Clark, 53, Chancery-lane, engineer. Improvements in the means of applying heat to the feet in boots, shoes, and otherwise, part of which improvements is applicable to other heating purposes. (A communication.)

3441. J. Fairless, Forth Banks, Newcastle-upon Tyne, machine broker. Improvements in apparatus or machinery for milking cows.

3443. E. Stevens, 139, Cheapside. Improvements in machinery for preparing dough and paste suitable for making bread, biscuits, pastry, cakes, and similar articles.

3445. J. and W. Lord, Rose Hill Iron Works, Bolton. Improvements in machinery for fluting rollers, used for preparing, spinning, and doubling fibrous materials.

3447. D. G. Hope, Grays, Essex, civil engineer. Improved machinery for obtaining and applying motive power.

3451. R. Knox, Swinton-street, Gray's-inn-road. Improvements in the manufacture of metallic pens.

Dated Dec. 26, 1862.

3452. W. Clark, 53, Chancery-lane, engineer. Improvements in firearms. (A communication.)

3453. C. F. Varley, Fortess-terrace, electrician. Improvements in electric telegraphs.

Dated Dec. 27, 1862.

3457. M. F. A. Courtois, Paris, gentleman. Improvements in wax or other candles and torches.

3459. J. Petrie, Rochdale, engineer. Improvements in slide valves for steam engines.

Dated Dec. 29, 1862,

3461. J. G. Taylor, Paris, merchant. Improvements in dress fastenings, and in the ornamenting thereof.

3463. J. H. Riddell, 155, Cheapside, stove and boiler manufacturer. Improvements in stoves.

3465. F. Tolhausen, 17, Faubourg Montmartre, Paris. The use of petroleum or coal oil as fuel, and also for the machinery and apparatus to be employed for this purpose. (A communication.)

3467. C. E. Wilson, Monkwell-street, City, manufacturer. Improvements in articles of wearing apparel for the neck.

Dated Dec. 30, 1862.

3470. J. Johnston, Pinstone-street, Sheffield, plumber and glazier. An improved surface refrigerator.

3471. J. Robson, jun., South Shields. Improvements in ornamental fittings for domestic stove grates.

3473. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. Improvements in the manufacture of saddles. (A communication.)

3474. F. B. Anderson, Birmingham, manufacturer. Improvements in watches and other time keepers.

3475. W. Bowser, engineer, and H. Bowser, ironfounder, Glasgow. Improvements in coating or protecting iron or steel with another metal.

3477. J. E. Carter, 3, Brownlow-mews, Gray's-inn-lane. Improvements in chimney tops.

3480. C. Beslay, 11, Rue Ménilmontant, Paris, civil engineer. Improvements in steam engines.

Dated Dec. 31, 1862.

3482. W. B. Adams, Holly Mount, Hampstead, engineer. Improvements in railways and tramways.

3484. J. S. Smith, Britannia, near Bacup, Lancaster, manufacturer, and J. Hardman, overlooker. Certain improvements in power looms for weaving.

3486. W. Clark, 53, Chancery-lane, engineer. Improvements in the arrangement of the parts of railway trains, and in the application of power for their propulsion. (A communication.)

Dated Jan. 1, 1863.

4. M. E. Bowra, Upper Norwood, manufacturer, and A. E. Francis, 10, Tokenhouse-yard, gentlemen. Improvements in the manufacture of elastic fabrics.

Dated Jan. 2, 1863.

12. W. A. Distin, Tavistock-row, Covent-garden. Improvements in pipes for smoking tobacco or other herbaceous compounds.

14. C. Eyland, Walsall, manufacturer. An improvement or improvements in the manufacture of buckles.

16. A. Bamford, Belle Flat-street, Richard-street, R. Blomley, Taylor-street, Whitworth-road, R. Taylor, 67, Manchester-road, and J. Lett, 9, Water-street, Rochdale. Improvements in looms for weaving.

18. W. H. Muntz, Milbrook. An improved method of attaching sheathing to iron or other vessels.

20. J. E. Dowson, 38, Dowgate-hill. Improvements in the manufacture of wrought metal piles, columns, and shafts.

22. A. S. Bolton, Birmingham, manufacturer. Improvements in the manufacture of wire.

Dated Jan. 3, 1863.

24. E. Skull, High Wycombe, Bucks, manufacturer, and E. Mealing, chair maker. Improvements in chairs and other seats or apparatus for sitting or reclining on, which improvements are also applicable to tables.

26. S. White, Suffolk-grove, Southwark, engineer. Improvements in the method of, and apparatus for, purifying, bleaching, and refining oils and oily and fatty matters.

30. W. E. Newton, 66, Chancery-lane, civil engineer. An improved method of firing or discharging cannon and other firearms, a part of which invention is applicable generally to the firing of charges of powder. (A communication.)

Dated Jan. 5, 1863.

32. H. Yates, Birmingham, edge tool manufacturer. Improvements in machinery used in the manufacture of shovels and spades, and for raising and shaping metals for other purposes.

34. J. Howard and J. Bullough, Accrington, iron founders and machine makers. Improvements in warping and beaming machines.

36. A. Monnet, 5, Rue de la Platiere, Lyon (Rhone), France. Improvements in twisting and throwing silk and other fibres.

38. H. Chamberlain, Langley Fawley, engineer. Improvements in generating and condensing steam, and evaporating liquids, and in the apparatus employed therein.

Dated Jan. 6, 1863.

42. C. T. Judkins, 22, Ludgate-street, sewing machine manufacturer. New alloys. (A communication.)

48. E. V. Gardner, Berners-street, professor of chemistry. Improvements in the treatment of petroleum and mineral oils, and in apparatus employed therein.

52. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in rocket torpedos, and in the apparatus for directing the flight of the same under water. (A communication.)

Dated Jan. 7, 1863.

58. W. Clark, 53, Chancery-lane, engineer. Improved media for advertising. (A communication.)

60. G. A. Huddart, Brynkir, Carnarvon, gentleman. Improvements in buttons.

62. G. Dowler, Birmingham, manufacturer. Improvements in the manufacture of match boxes.

Dated Jan. 8, 1863.

68. A. Guild, Dundee, gentleman. Improved machinery for breaking and cleaning flax, hemp, and other fibre yielding plants. (A communication.)

INVENTION PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF A COMPLETE SPECIFICATION.

Dated Jan. 8, 1863.

67. L. Hull, Massachusetts, United States. Having reference to the treatment of ground caouchouc, and for the purpose of rendering it elastic or improving its elasticity, as well as imparting to such caoutchouc other useful properties.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette.*

2480. F. Selby. Traction engines.

2482. J. Walker. Oil presses.

2483. T. Fleitmann. Manufacture of copper from copper ores.

2490. A. Barclay. Traction engines.

2495. W. A. Munn. Capping, loading, and closing cartridges.

2496. T. Steel. Treating soap suds.

2503. L. C. Hoyau. Marking time.

2504. J. Thomson. Treatment of vegetable fibres.

2505. A. Barclay. Locomotive, boring, and winding engines.

2508. P. Ward. Manufacture of a double sulphide of calcium and sodium.

2511. A. E. H. B. Butler. Straightening and polishing cylindrical bars of iron and other metals.

2519. H. Higgins. Opening, cleansing, or carding fibrous materials.

2522. H. J. Lewis. Engines.

2525. T. W. Cowan. Pumps.

2529. E. G. Chant. Self-binding portfolios, and holders for newspapers.

2532. E. Balmforth. Finishing textile fabrics.

2533. W. L. Tizard. Construction of ships, vessels, cupolas, and forts.

2541. S. Flexen. Ventilating carriages.

2543. R. Moreland, jun. Preparing and cutting hops.

2556. L. Mond. Obtaining hypo-nitric acid and nitric acid from nitrate of soda.

2562. J. W. Woodford. Driving and drawing piles, also for raising soil.

2563. T. Watts. Thrashing machines.

2581. B. Hotchkiss. Hammers.

2593. T. Knowles, J. Houghton, W. Knowles, and W. Houghton. Looms.

2597. R. A. Brooman. Lighting apparatus. (A communication.)

2604. R. A. Brooman. Composition for painting. (A communication.)

2637. J. Brown. Carding engines.

2645. H. Ellis. Improvements in the manufacture of compounds of silica.

2702. C. Chinnock. Axle boxes.

2775. J. H. Johnson. Sewing machines. (A communication.)

2979. J. H. Johnson. Hanging, arranging, and operating ordnance. (A communication.)

3203. T. Evans. Coverings for the leg and thigh.

3336. J. W. Baker. Spinning fibrous materials.

3478. W. Richards. Cannon and other firearms.

3484. J. S. Smith and J. Hardmann. Looms.

8. J. Jones. Finishing or stiffening textile fabrics.

24. E. Skull and E. Mealing. Chairs and other seats.

30. W. E. Newton. Firing or discharging cannon and other firearms. (A communication.)

68. A. Guild. Machinery for breaking and cleaning flax, hemp, and other fibre yielding plants. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Jan. 16th., 1863.

2049. T. B. Daft.
2051. J. Willcock.
2057. C. A. Day and T. Summers.
2060. R. Barrett.
2061. R. A. Brooman.
2070. E. Bazin.
2071. W. E. Gedge.
2072. T. Davey.
2119. A. Lahousse.
2158. W. E. Gedge.
2163. J. Benyon.
2165. W. Clark.
2373. J. A. Coffey and T. Redwood.
2872. J. Carpendale.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

100. M. A. F. Mennons.
116. S. Fearnley.
129. A. Chaplin.
127. G. J. and T. Barker.
147. G. H. and H. R. Cottam.
120. J. F. Spencer.
130. W. W. Hewitson and B. Walker.
149. F. J. J. De la Ferte.
299. G. A. Biddell.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

120. J. Fowler.
122. H. R. Worthington.
162. P. L. T. Lacroix.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending January 23, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1687	0 6	1702	3 10	1717	0 4	1732	1 10	1748	0 8	1763	1 0
1688	0 10	1703	1 6	1718	0 8	1733	0 8	1749	0 4	1764	0 6
1689	0 4	1704	0 4	1719	0 6	1734	0 8	1750	0 4	1765	0 4
1690	2 0	1705	0 4	1720	0 4	1736	0 10	1751	0 4	1766	0 8
1691	0 10	1706	0 4	1721	0 10	1737	1 6	1752	0 4	1767	0 8
1692	2 6	1707	0 6	1722	0 10	1738	0 8	1753	0 10	1768	1 10
1693	0 4	1708	1 0	1723	0 10	1739	0 10	1754	0 6	1769	0 10
1694	0 8	1709	0 8	1724	0 4	1740	0 8	1755	0 4	1770	0 4
1695	0 4	1710	0 10	1725	0 4	1741	0 4	1756	0 4	1771	0 4
1696	0 8	1711	0 10	1726	0 10	1742	0 4	1757	0 4	1772	0 4
1697	0 4	1712	0 8	1727	0 4	1743	0 4	1758	0 4	1773	0 10
1698	0 4	1713	0 8	1728	0 4	1744	0 4	1759	0 10	1774	1 0
1699	1 6	1714	0 8	1729	0 4	1745	0 8	1760	1 8	1775	0 8
1700	0 4	1715	0 4	1730	0 4	1746	0 4	1761	0 4	1776	0 4
1701	0 10	1716	0 4	1731	0 10	1747	0 4	1762	0 4		

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback, 1s.

	£	s.	£	s.
Teak ....load	14	0	15	0
Quebec, red pine	3	10	4	10
,, yellow pine	3	0	4	0
St. John, N.B., yellow	5	0	5	10
Quebec oak, white	5	10	6	10
,, birch	3	0	3	10
,, elm	3	10	5	0
Dantzic, oak	3	10	6	10
,, fir	2	10	3	10
Memel, fir	3	0	3	5
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzig, fm	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	19	10
St. John, white spruce	14	10	16	10
Yellow pine, per reduced C.				
Canada, 1st quality	17	0	18	0
,, 2nd do	11	0	12	0
Archangel, yellow	13	0	13	10
St. Petersburg, yellow	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white	9	0	9	10
Gefle, yellow	10	0	11	10
Soderhamn	9	10	10	0
Christiania, per C., 12 ft. by 3 by 9 in.				
,, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	11	1	4
PUMICE STONE, per ton	5	10	9	0

OILS, &c.

	£	s.	£	s.
Seal, pale ....per tun	48	0	0	0
Sperm body	85	0	86	0
Cod	46	0	47	0
Whale, South Sea, pale	44	0	0	0
Olive, Gallipoli	60	0	60	10
Cocoanut, Cochin	57	10	0	0
Palm, fine	39	10	40	0
Linseed	43	0	0	0
Rapeseed, English pale	53	0	53	10
Cottonseed	33	10	43	10

METALS.

		£	s.	d.		£	s.	d.	p.ct.
IRON:									
Welsh Bars, in London	per ton	6	10	0	to	7	0	0	2½
Nail Rods	,,	7	10	0	,,	7	15	0	,,
Hoops	,,	8	10	0	,,	9	0	0	,,
Sheets, single	,,	9	5	0	,,	9	10	0	,,
Staffordshire Bars	,,	7	15	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	6	0	0	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	15	0	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
STEEL:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	10	0	,,	18	0	0	,,
COPPER:									
Sheet and Sheathing, and Bolts	,,	105	0	0	,,	0	0	0	3
Hammered Bottoms	,,	115	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	110	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	98	0	0	,,	0	0	0	,,
Tile Copper	,,	98	0	0	,,	0	0	0	,,
Best Selected	,,	101	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	11	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	9½	,,	0	0	0	3to7½
Fine Foreign	per ton	98	10	0	,,	0	99	0	3
TIN:									
English Block	pr cwt.	115	0	0	,,	0	0	0	2½
Bar	,,	116	0	0	,,	0	0	0	,,
Refined	,,	120	0	0	,,	0	0	0	,,
Banca	,,	119	0	0	,,	120	0	0	nett
Straits	,,	117	0	0	,,	118	0	0	,,
TIN PLATES:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
LEAD:									
Pig, English	per ton	21	10	0	,,	22	0	0	2½
Spanish, Soft	,,	20	10	0	,,	0	0	0	,,
Shot, Patent	,,	23	10	0	,,	0	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	27	10	0	,,
SPELTER:									
On the spot	,,	18	2	6	,,	18	5	0	nett
ZINC:									
English Sheet	,,	23	5	0	,,	23	10	0	2½
QUICKSILVER	pr btl.	7	0	0	,,	0	0	0	3
REGULUS OF ANTIMONY:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

The "Illustrated London News," Nov. 8, speaking of Benson's Watches in the Exhibition says—"Ranged around the base of the clock were the Watches which Mr. Benson exhibited, and which have been universally admired for the beauty and elegance of the designs engraved upon them. The movements are of the finest quality which the art of horology is at present capable of producing." Chronometer, duplex, lever, horizontal, repeaters, centre seconds, keyless, split seconds, and every description of watch, adapted to all climates. Benson's Illustrated Pamphlet on Watches (free by post for two stamps) contains a short history of watch making, with descriptions and prices. It acts as a guide in the purchase of a watch, and enables those who live in Scotland, Ireland, Wales, the colonies, India, or any part of the world, to select a watch, and have it sent free and safe by post. J. W. Benson, Prize Medallist, 33 and 34, Ludgate-hill, London. Established 1749.—[Advt.]

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JANUARY 30, 1863.

MR. E. J. REED.

WE are sure our readers will be glad to hear that Mr. E. J. Reed has been appointed Chief Constructor of the Royal Navy. This appointment reflects as much credit on the Lords of the Admiralty as it does on Mr. Reed. Mr. Reed is pre-eminently a self-made man. Without possessing the advantages of birth, connection, or wealth, he has, in a very few years, purely by his own ability, industry, and integrity, gathered around him friends, inspired confidence in men of reputation and authority, and won a position which is too frequently only obtained by the labours of a life. The principal events of Mr. Reed's career are too well known to our readers to be enlarged on here. He was honourably connected with this Journal as editor for eight years. About three years since he was mainly instrumental in establishing the Institute of Naval Architects, which has already rendered signal service to ship building. Since then he was appointed by the Admiralty to superintend the construction of the "Enterprise," "Favourite," and other vessels of his own design. Having succeeded so well in everything he has undertaken, we were not surprised at his appointment as Chief Constructor of the Navy. It is not often that so young a man as Mr. Reed is called on to perform the duties of so responsible an office. The most deserving men among us have too frequently to wait many long and weary years before they are appreciated as they should be, or rewarded as they deserve. They are obliged to waste the best part of their lives in obscurity or neglect. Somehow or other our authorities, who are almost all old men themselves, have a decided partiality to old men to fill important positions. Preference is too often given to seniority at the expense of merit, and influence and connection usurp the claims of worth. This too general rule has been reversed in Mr. Reed's appointment. Being young, it is in his power to give the department which he superintends the best energies of his life. Mr. Reed is not, as the Emperor of the French said of a popular Prime Minister of this country, "animated with the prejudices of a past age." He is not wedded to any antiquated theory or system; and if he is wise he will not commit himself to any particular principle either in the material or the mode of constructing ships. We are necessarily in a transition state. What was best two years since may not be best now, and what is best now, may not be best two years hence. We cannot fix any boundary to the possibilities of science. The mind of inventors and men of thought being, at the present time, on the stretch for new ideas and plans and principles; and changes and modifications succeed each other so rapidly, that we believe him to be the wisest to superintend any important work, who is ready to listen to all legitimate proposals, and who spreads his sails to catch the most favourable breeze for the national advantage. We have repeatedly stated that we considered it a mistake to appoint such a man as Sir William Armstrong, an inventor and *quasi* manufacturer and contractor, and a man necessarily interested in promoting his own invention at the expense of others, as engineer of rifled artillery. Every man must be more or less prejudiced in favour of his own offspring, even if his intentions be good. And when a man with a favourite system, a fixed idea, or a cut and dried policy, is appointed to a position of trust and responsibility in the army or navy, at such a time as this, when the applied sciences are absolutely revolutionizing our modes and materials of warfare, the public service may be neglected for the sake of a prejudice, or from individual interest. Mr. Reed not being an inventor, cannot be charged with neglecting other inventions for the sake of his own; and we hope, and are inclined to believe, whatever may be said to the contrary, that he is not committed to any particular principle in ship-building, but will be ever ready and willing to adopt any principle which he conscientiously believes to be the best. We most heartily congratulate him on his worthily achieved success, and sincerely hope that his future career will be as useful to the public service as his past efforts have been creditable to himself.

THE NORTH-ATLANTIC SEA-BED.[*]

IT is not often that it has fallen to our lot to peruse a work more replete with scientific interest than this contribution to the natural history of the sea; and the Admiralty must certainly be congratulated on having, in one instance at least, put "the right man in the right place." It is questionable, indeed, whether "my Lords" could have made a more fitting selection than that of Dr. Wallich, for the performance of the service, which has eventuated in the publication of the pamphlet under review. That gentleman, in addition to high scientific acquirements, brought to bear upon the task with which he was entrusted in 1860, the advantage of much experience of the kind most required. He had already served in the capacity of naturalist to Sir F. L. M'Clintock's expedition for the survey of the proposed North Atlantic Telegraph route between Great Britain and America, and he had also published a series of instructive "Notes on the Presence of Animal Life at Vast Depths in the Sea."

It was on the 2nd of July, 1860, that Dr. Wallich left Stornaway in the "Bulldog," on what may be justly termed his voyage of discovery in the North Atlantic. The descriptive powers of the Doctor are very satisfactorily revealed in the diary which he constantly kept, and his pictures of scenery and atmospheric phenomena, witnessed or experienced during the progress of the cruise, could scarcely be excelled in vividness and reality. On this account alone, "The North-Atlantic Sea-Bed" would be worthy of attention, but it has far higher claims to public approval, as will presently be seen.

Very early after his departure from Stornaway, the explorer commenced taking soundings, and thus making the ocean's bed tell its own story. On the ninth of July, and at a point about two-thirds of the distance from the Faroes and Iceland, the sounding instrument "brought up, from a depth of 682 fathoms, a piece of quartz rock about an inch square, several fragments of basalt, an old and much worn fragmentary valve of *Pollicipes*, a minute pellet of mud about the size of a pea, a calcareous *Serpula-tube*, about half an inch in length, and evidently just broken off from the stone to which it was attached, inasmuch as the fleshy matter was perfectly fresh at the point of fracture, and, lastly, a minute *spirorbis*, and two shells of *Truncatulina lobata*, still adherent to small stones, and apparently alive." Here were abundant materials for examination, and Dr. Wallich does not lose the opportunity of effecting it. With patience and extreme care each specimen was inspected, and, finally, important conclusions were drawn from their various peculiarities. The principal point established by this and successive soundings in the same vicinity was to the effect that "an offshoot of the Arctic current moves slowly downwards between the Faroe Islands and Iceland." The extreme and sometimes sudden variations in depth demonstrated by the sounding apparatus are not among the least remarkable phenomena of the ocean. "At a distance of 40 miles to the westward we find 64 fathoms, then a plateau of nearly 70 miles diameter, on which the depth varies between 40 and 100 fathoms; and, lastly, another dip of 640 fathoms, which decreases to 445 fathoms at 17 miles distance from the Icelandic coast." Dr. Wallich does not, however, consider that these alternations of level are of sufficient extent to prevent, if need be, the laying across them of a telegraphic cable. Further surveys would, nevertheless, be requisite, in order to gain indications of the valley lines, and to select for its submergence the most favourable course. "Wherever the valleys happen to be narrow and irregular, no matter how slowly a cable may be paid out, festoons would form, the weight of which, acting on the points of contact, would inevitably engender a fatal strain."

It is curious to imagine the process of surveying the "deep bosom of the ocean," as though it were dry land, over which a railway were to be carried, but no doubt exists of its perfect practicability.

The microscope was frequently pressed into the service of the enquirer into the mysteries of the sea, and it often revealed facts upon which to base theories and hinge deductions. In truth, that instrument proved a valuable adjunct to the scientific apparatus.

On the 19th of July the "Bulldog" had approached to within thirty miles of Greenland, and we cannot forbear transcribing the author's impressions on a yet nearer view of that place:—"Before us, stretched in a long line, extending as far on either side as the eye could reach, lay the rugged mountain ranges that hem in the eternal desolation beyond. No gentle slope mingled with the outline of the innumerable icy peaks which stood out against the horizon with an almost terrible distinctness, but everywhere was to be witnessed the stern grandeur of a scene, beside which the snowy ranges of the Himalaya, majestic as they are, would appear subdued into tameness. Between the ridges, the snows of centuries had filled up the chasms, and hid from view all but the most perpendicular faces of rock. No portion of the shore line was visible; yet its position and direction could be determined by the differences in character of the fixed or floating ice. From it, to within a short distance of the ship, extended a dense mass of aggregated pack ice, out of the midst of which at intervals huge bergs reared up their glistening sides, whilst floating clear of the pack, detached masses were to be seen, whose battered condition told of many an Arctic blast and wave. . . . The attempt to describe such a scene is vain; the eye may gaze upon it and admire, but the soul, as if conscious of God's presence, bows down in adoration, and is speechless."

The rugged and inhospitable grandeur of

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[*] The North-Atlantic Sea-Bed: comprising a Diary of the Voyage on board H.M.S "Bulldog," in 1860; and Observations on the Presence of Animal Life, and the Formation and Nature of Organic Deposit at Great Depths in the Ocean. By G. C. Wallich, M.D., F.L.S., F.G.S., &c., &c., &c. Part 1. London: John Van Voorst, Paternoster-row. 1862.

this place may be well imagined from the Doctor's picture of it.

The greatest depth of water between Iceland and Greenland, a distance of some 600 miles, was found, half way accross, to be 1,572 fathoms, the descent down to that point being apparently very regular. "The ascent was equally regular up to a point about fifty miles from the east coast of Greenland. But here a sudden and remarkable rise was met with, the depth decreasing from 806 to 227 fathoms in three and a quarter miles; that is, at the rate of 1,050 ft. per mile!"

Gladly should we accompany our excellent guide and exponent in his further experimentations, but space warns us that we must not linger even in his pleasant and profitable company. His learned and highly interesting discourse as to the "Bathymetrical limits of life in the ocean," and his reasons for arriving at conclusions somewhat at variance with commonly received notions thereon, can only be commended to the notice of our readers, should they haply meet with the book in which they appear.

Never before has such a flood of light been poured into the depths of the sea, nor so much information been given of the deepest located of its inhabitants. It is, therefore, impossible to rate too highly the publication which introduces to the public Dr. Wallich's tidings from the "North-Atlantic Sea-Bed."

THE PREVENTION OF ACCIDENTS IN MINES.

The frequent occurrence of appalling accidents in mines and coal-pits tends to cast discredit, not only upon those who are entrusted with their practical management, but upon scientific and mechanical men generally. Scarcely a week passes without the public being shocked by the perusal, in our journals, of the details of some disaster more or less fatal in its consequences in the collieries and mines of this country. It may be said that many of these casualties are unavoidable, and contingent upon the exceptional nature of the operations in the performance of which they occur. To this statement we cannot, however, lend our sanction. We believe that in a great majority of cases—even with the existing arrangements—such fearful catastrophes as those, with which we have lately become familiar, might have been prevented. Too often has it happened that inquests and inquiries have evolved the fact that the exercise of a little more foresight and care would have obviated the necessity of such inquests and inquiries, and have saved many valuable lives. It cannot be denied, nevertheless, that the means of working mines generally, and especially the mechanical adjuncts employed therein, are defective. There is too much haphazard, and not enough system, in the conduct of mining work, as a rule. Those, therefore, of our ingenious mechanics and engineers who are disposed to turn their attention to the solution of the problem, "How to prevent accidents in mines," are deserving of all encouragement and will find a wide field opened up for the exercise of their skill.

Strongly impressed ourselves with the vast and vital importance of the subject, we are determined to promote in every possible way all reasonable projects for the accomplishment of the great object sought, namely, the minimizing of mining accidents. It has, indeed, become almost a national question, and it is one which must, sooner or later, be solved satisfactorily.

Under the influence of these feelings, we this week direct the attention of our readers to a comprehensive plan for the prevention of accidents, illustrations of which are to be found on another page, and which has been forwarded to us by Mr. James Rae, of the Greenwich Iron Ship Building-yard. That gentleman has, ever since the occurrence of the dreadful accident at the Hartley Colliery, about twelve months ago, devoted much time and attention to a consideration of the most effectual means for saving life in mines. He has endeavoured, by a careful examination into the varied causes of past disasters, to devise means for preventing future ones. It will be for the mining authorities and the public to judge in how far he has been successful in his praiseworthy task. Mr. Rae modestly guards himself against claiming the merit of complete originality for every point connected with his scheme, but he has not, in a single instance, servilely borrowed an idea from the work of any predecessor in the same path. Our engraver has rendered justice to the admirable drawings furnished by Mr. Rae, and, consequently, the illustrations almost tell their own story. *(See page. 68.)*

Fig. 1 is a sectional elevation of main shaft, with an iron pipe on either side. These pipes are intended to serve a variety of purposes. Exteriorly they are designed to form guides for the cage or carriage in its ascent and descent; they are also furnished with ratchet teeth, which, in conjunction with an apparatus attached to the cage itself, will effectually prevent the fall of the latter, in case of a breaking rope. The pipes are also intended to serve for the ventilation of the mine by allowing of the pumping out of the gases and foul air, fresh air rushing down the main shaft to supply their place. One of the most important parts played by these universal tubes remains to be told. In cases of emergency they become safety ladders for the escape of the miners!

A loaded coal waggon is shown resting upon palls locked in the ratchet teeth, as would be the case if the lifting rope had broken.

Fig. 2 is another sectional view, representing the front of the ratchet guide, and the side of the exhaust fan.

Fig. 3 is a sectional plan of main shaft through the exhaust pipes and pump.

Fig. 4 comprises a plan of main shaft with the two *blasts* or exhaust fans, for these may be used for sucking or blowing.

Fig. 5 is a cross section of main shaft.

Fig. 6 side elevation of fans.

Fig. 7 is a vertical section, showing one of the pipes in the act of being used as an escape ladder. The existence of such contrivances as these at the Hartley colliery would have enabled every imprisoned man and boy to have emerged from his living tomb.

A, Represents loaded coal waggon.
B, Escape door at bottom of pipe.
C, Escape door at top of pipe.
D, Front elevation of disconnecting hook.
E, Entrance to pit at the foot of shaft.
F, Ladders by which to enter escape pipes.
G, Exhaust pipes under ground.

By a careful inspection of the accompanying engravings, it will, we think, be seen that the inventor of this new mode of preventing accidents has had an eye to every probable, if not to every possible, cause of such deplorable events as have been referred to. Whilst suggesting the adoption of his entire plan, wherever practicable, Mr. Rae proposes also improvements in existing arrangements. He would, for example, recommend that in all cases the vertical shafts of pits and mines should be lined with cast iron, the lining to be put together in segments, connected by bolts and nuts. The joints should be caulked with cement. The segments should be cast of suitable lengths, and provided with flanges for uniting them horizontally and vertically. A curb of this kind might be carried to any depth, and made perfectly water-tight. Once properly constructed, it would last for any length of time. Curbs formed of wood, on the contrary, are continually decaying and becoming leaky, no matter how well fitted in the first instance. Iron curbs, therefore, says Mr. Rae, will be found not only more durable, but in the end cheaper than wooden ones. In this conclusion most persons who have had any experience in the matter will feel disposed, as we do, to join. Moreover, the substitution of iron for wood, would have the advantage of paving the way for the introduction of escape tubes, which certainly have much to recommend them, and do away altogether with the necessity for the much talked of "second shaft."

In reference to the means of preventing the fall of the cage when its suspending rope has broken, he remarks that the guides might be "either cast on the pipes, or be bolted to them, being in either case placed perfectly true. The faces of the guides should both be cast with teeth upon them in the usual form of the ratchet, and be of about 4 in. pitch and 12 in. broad. The permanent hoist carriage should be made of wrought iron, with guide blocks fitted on either side to fit the vertical guides on the tubes. The guide blocks might be furnished with friction rollers, so as to reduce friction in ascent or descent to a minimum. On the under side of the carriage there should be fitted two catches or palls, working in slots or grooves. The palls would be kept out of gear, so as to allow the free motion upwards or downwards of the carriage, but by the arrangement I propose they would be relieved the instant the hoist rope or chain broke, and locking themselves in the teeth of the vertical ratchet, would suspend the carriage until it was again made fast to the repaired or replaced rope."

The arrangement by which this important object is proposed to be effected is, we must say, exceedingly ingenious, and yet so simple that its failure in action seems to us to be impossible. The palls are acted upon by powerful springs, which come into play self-actingly on the occurrence of such an accident as that named, and once adjusted will not require even looking at, much less repairing, for years.

A disengaging hook for preventing the "overwinding" of the cage, as it is termed by miners, forms another feature in Mr. Rae's plans for saving life, and an excellent feature it is. It is well known that hundreds, if not thousands, of lives have been sacrificed from this unfortunate cause. Too often the engine-driver has been at fault; but Mr. Rae's disengaging hook is a perfect safeguard against carelessness in this direction. The instant the cage has reached its proper height, the hook detaches itself from the carriage, and the latter, with the men or material within it, remains stationary at the mouth of the pit.

We have endeavoured to give a general outline of the whole of the arrangements proposed by Mr. Rae; but, of course, there are many points of detail into which we cannot at present go. For the information of those of our readers who may take especial interest in the subject, we may state further that a model of a coal pit, fitted with all the appurtenances named above, has been constructed by the talented gentleman in question, and that it may be seen on application at the office of the MECHANICS' MAGAZINE.

The ventilating process, as projected in this instance, does seem to us, moreover, to entitle its inventor to the consideration of the Nationa

Association for the Relief of British Miners, who some time since offered a premium of 200 guineas "to any engineer or other person who projects and carries into effect the best and most effective plan for the perfect ventilation of mines." It is decidedly our opinion that no better "plan" exists, at present, for the ventilation of mines than that proposed by Mr. James Rae. We shall be glad, therefore, if the association give him the opportunity of demonstrating, with more minute detail than it is possible here to give, the merits and peculiarities of his mode of saving life in mines.

FORTIFICATION.

Treatise on Fortification; or, Lectures delivered to Officers Reading for the Staff. By Capt. LENDY, F.G.S., F.L.S., &c., Director of the Practical Military College of Sunbury. W. Mitchell: Charing-cross, London.

THE military direction which the public mind has of late taken, has rendered a knowledge of the general principles on which the art of war is practised almost essential to a polite education. The daily papers teem with articles "horribly stuffed with epithets of war," which are unintelligible to most readers, yet under these terms some eight millions of money will have been spent within the next few years, and that is sufficient justification of the curiosity to know what permanent forms this gigantic expenditure is to assume. Were it practicable to write a popular handbook to the whole art of war, it would be just now a most useful publication; and, if the present state of things continues, it would grow into an indispensable *vade mecum* to the breakfast table, or a young lady's pocket companion. Though it is too much to expect that a science like that of military engineering should be made plain to the commonest understanding, as some empirics pretend to do, it must certainly be desirable that the means to the acquirement of a knowledge of it should be made as easy as possible. And it is the great merit of Capt. Lendy's lectures that, although they are addressed to military men, who have a previous knowledge of the subject, they are so distinct and clear that a man of ordinary mathematical attainments can easily master the art of fortification all the more easily if the author had embodied in his work a table of definitions, as in Major Straith's treatise; for we labour under this disadvantage, that nearly all the terms are borrowed from the French, and that their significations are often forced and unnatural.

Since the days of Vauban, fortification has always lagged behind. The means of defence have never equalled the means of attack, so that the idea of an impregnable fortress has become obliterated, and a city or position is fortified, not in the expectation of preventing it from ever being taken, but simply with a view to delay its capture to the latest possible period, and until time has been afforded for relief to arrive to compel the enemy to raise the siege. If this axiom be borne in mind, it will be seen that, although a fortified post enables a small force to resist a a numerous foe, yet an army, able to compete with the foe on equal terms, is required to prevent the post from ultimately falling into the enemy's hands. Consequently, the costly and extensive works now in the course of erection to protect our naval yards and arsenals will not render them impregnable, nor relieve us from the expense of maintaining a single soldier the less. The utmost the works will do will be to protect the yards from a *coup-de-main*, and allow time for the army to meet the foe. Nor must it be fancied that iron clad forts will be secure from attack, for besiegers do not rely upon artillery fire alone to overcome resistance. They have, in addition, two formidable weapons—mines and blockade—and, moreover, their fire is converging while that of the besieged is diverging; so that the relation between the means of defence and attack remain as it has been since Vauban; and the utmost fortifications can do is to create delay. This does not mean that fortifications will not preserve the position from capture; but in cases where they do so, it will be fonnd that the enemy's defeat arises either from the exhaustion of his force or the failure of his supplies, or interruption of his communication, or from the advance of an overpowering relieving force. At the time the fortified *enceinte* of Paris was discussed and decided upon, it was never suggested by the most urgent advocates of the proposition, that it would, of itself, prevent the city from being captured, but simply that it would allow the garrison and National Guard (as inferior troops fighting under cover) to hold out during 30 days, which would be time sufficient to allow an army to assemble behind the Loire and to march to the relief of the capital.

Military engineering, like ship-building, is, we think, reduced to a state of transition, consequent upon the immense development of the means of attack, due to the introduction of rifled artillery and fire arms; yet both here and on the continent, we fancy old measurements and dimensions are retained. Engineers formerly laid down the maximum length of the lines of defence at 250 yards, which, being greater than the range of musketry, lead to the employment of wall pieces. But as the Enfield has now an effective range of 900 yards, whereas the old musket could not be relied upon beyond 180 yards, it may be very fairly presumed that the length of the lines of defence may be increased without diminishing their value. Capt. Lendy admits they may be increased to 300 yards, and that some engineers have proposed an extension to 500 yards, but he doubts if a soldier can see a man in the trenches at that distance. The increase of 50 yards upon the whole length is very slight, and does not at all correspond with the increase of range obtained. When the lines of defence are made longer, the front will also be increased in length, and the number of salients, and therefore of points of attack, will be the fewer. There would, consequently, be less labour and time—both of which mean money—expended on the defence, were it not that the works will require to be made much stouter to resist the augmented range and penetrating effect of the enemy's artillery. And they will require to be more frequently provided with cover for the artillery. On the other hand, the attacking force will have to commence operations at a greater distance than hitherto, which has been 600 yards for the first parallel. With the present range, besiegers could not remain at this distance without cover, nor probably at anything under 1,000 yards in ordinary cases, and where the nature of the ground is not adverse. The approaches, therefore, will be more laborious and more tedious, and he will be the longer kept under fire, so much so that Capt. Lendy is inclined to believe sapping will be abandoned in favour of mining.

It is very satisfactory to find so important an authority as the writer unite with D'Arcon in protesting against the "*professional system* which has the effect of spoiling all our ideas," and insisting on the necessity of taking common sense as a guide. D'Arcon had laughed at the men of one idea, who, like the leather-seller in the fable of the besieged town, declared that their particular hobby was all that was necessary for defensive purposes—at the linesman, who would trust solely in infantry; at sailors, who would rely upon ships alone; artillerists on coast batteries; and he surmised that cavalry mounted on hippopotomi might be suggested for defensive manœuvres. And Captain Lendy contends that engineers are equally absurd in imagining that nothing but fortifications are needed to insure the quiet possesion of the country; adding, as becomes a staff-officer, "Amid this variety of opinions nothing seems to have been forgotten, except the indispensable necessity of their *being all united*, and made to concur conjointly towards the same end." In the present day engineers are in the ascendant, and our rulers appear more than ever to rely on walls and earthworks for defence, but they appear to forget that fortified towns and positions, as protection against invasion, are more matters of routine than of demonstrated utility. When the modern system of fortification was introduced, it found the frontiers of continental states protected by triple lines of fortresses. Instead of ascertaining whether the arrangement were wise or not, engineers adopted it, and contented themselves with adapting the works to resist modern artillery. But invading armies now are generally numerous enough to be able to pass between the fortresses, and to neglect the garrisons they can contain, and to prevent them from cutting their lines of communication by detaching a corps of observation. Undoubtedly the great mistake committed by Napoleon in 1814, and that which contributed more than anything else to secure victory to the standards of the allies, was his scattering his troops as garrisons, and shutting them up in Dantzic, Homburg, Glogau, and other fortified towns, instead of concentrating them on the Rhine, the frontier of his empire. The lust of territorial aggrandizement—the very possession of that which Napoleon had fought for—was the immediate cause of his ruin; and he who in his Italian campaign had taught how victory was to be won in spite of fortresses, and in neglect of them, was destined to fall when he reversed the strategy of his youth.

Seeing how frail a barrier are triple lines of the strongest fortresses to the advance of a numerous and disciplined army, led by an enterprising commander, most civilians will be inclined to reply in the affirmative to the question which the author puts, "Whether this enormous outlay on artificial defence is not altogether useless?" He estimates the mean cost of a fortified town at £600,000; and a frontier of 150 miles long would require 21 such strong places. France had, in 1829, 186 fortresses; and Bureau de Pusy declared that, with their annual cost for maintenance alone, an army of 100,000 men could be organized. In 1840, the Thiers' Ministry ordered the fortification of Paris. What the real cost was, no one can tell. It has been variously stated from three and a half to eight millions sterling; and since then most continental States have adopted, as a system, the fortification of the capital, and the erection of a zone of fortresses on the frontier, consisting, sometimes, of as many as four lines. These would be all very well if the invader would sit down before the obstacle provided for him, but that he is not likely to do. Unless he be purblind, he will seek to make his attack on a point which is not prepared to resist, and not run his head against a stone wall, built for the very purpose of cracking his skull. And "let us remember that at present armies are more numerous, and more rapid, in their movements than formerly, and that a fortress has no influence but on the ground, covered by its guns, and *that* it is only when it is a place situated *there*, and *there* only, *where* the enemy must pass, that permanent fortifications are advisable."

In the present transitional state of the means of attack and defence, it does not seem very prudent or economical to expend large sums on fortifications. We are quite willing to make dockyards an exception in deference to the authorities, but among them it is notorious difference of opinion exists as to the proper mode of applying the money; and many think the works at Portsmouth, for instance, unnecessarily large and massive. Rear-Admiral Robinson said no extent of fortification could make it safe from insult; and people point to Paris, which was considered, twenty years ago, to have been made as strong as it was possible to make it with its bastioned *enceinte* and girdle of detached forts; but now it is admitted that rifled artillery would make very short work of the defences of our neighbour's capital, and that, so far as it could offer any effective resistance, it might as well be left open. Beyond the glacis is a zone, called *Rayon de servitude militaire*, on which it is forbidden to erect any permanent construction. The consequence is that, besides the compensation paid in the first instance by the State, the owners of the land are unable to make the most of their property. Increased range has rendered the zone insufficient, and it will have to be extended at farther cost and inconvenience. The forts ought to be pulled down and removed farther off, else, if they and the bastions are ever engaged at the same time, they will run great risk of firing into one another. It may be answered, that, if we are to wait until the means of attack are developed to their full extent, we should never begin, and that we should therefore be liable to be surprised at any time; but what has been said with reference to continental lines of fortresses, is equally applicable to maritime frontiers, namely—that the foe will not always pass where you are prepared to resist him. Our chief line of defence is assuredly the navy, but it is quite within range of probabilities that it may be broken by storm, or forced, or eluded. In that case the foe would seek either to reduce our naval strength by destroying the yards, or to subjugate the kingdom by taking possession of the capital. The latter no amount of fortification on the maritime frontier could preserve, if the invader were in sufficient force, as he undoubtedly would be, and therefore it is foolish to speak of the works at Portsmouth as though they were capable of arresting a hostile advance upon London—as though they were outworks of the capital. The only ground on which they can be justified is as protection to our naval resources. Works may be also required to afford protection to commercial harbours and anchorages, but anything like the system of martello towers is absolute folly. Making common sense his guide, rising above professional routine, and disdaining slavish obedience to continental examples, Captain Lendy says, that "the capital should be made secure against surprise, famine, and bombardment (by no means easy when its population is counted by millions), but that the defence of the territory should be entrusted to active forces—the army." A good system of signals, which the electric telegraph supplies; roads parallel to the coast, which we have, in addition to the coast railways, that would allow what the Duke of Wellington said would enable him to defend the Isle against the world in arms—the defenders to move rapidly, and mass overpowering forces on the flank of the foe; a well-disciplined and moveable army, and a properly-organized reserve, all of which we possess in the Army, Militia, and Volunteers; and "Field fortification, well understood, will make up for inferiority of numbers in almost every circumstance of war."

GOVERNMENT ENGINEERS AFLOAT AND ASHORE.

Under the above heading an article appeared in the Mechanics' Magazine of the 2nd inst. It reflected with some severity upon the appointment of Mr. Bannister as Assistant Engineer of Woolwich Dockyard, on the ground of that gentleman's alleged deficiency of practical engineering experience. It is only fair to Mr. Bannister to say, that since the publication of the article in question, we have seen several testimonials as to his ability as an engineer, and which induce us to think differently of his qualification for the post he holds. We retract nothing, however, of our strictures upon an Examination system, which tends to elevate the mere mathematician and theorist above the practical man.

Literature.

Treatise on the Mathematical Theory of the Steam Engine; with Rules at length and Examples worked out for Practical Men. By T. Baker, C.E., Author of "Statics and Dynamics," &c., &c., &c. London: Virtue Brothers and Co., 26, Ivy-lane, Paternoster-row.

This little volume, forming No. 139 of the series of Rudimentary Scientific works, the publication of which, originally commenced by the late Mr. Weale, is now carried on by Virtue Brothers, has some claims to the notice of "practical men." We question, nevertheless, its ever being very extensively consulted by them. There are marks of haste, not to say, carelessness, in its compilation, which must tend to lessen its value considerably, and besides, it is not precisely what it professes to be. To those who are yet in their student days it may be of some service as an introduction to the study of more important and abstruse volumes, and this is the highest praise we can conscientiously accord to it.

One does not usually look for fine writing, or what is termed "flowery" language, in mathematical treatises, but these have been attempted in the work before us. With what success our readers shall judge. After describing the "simple operations" which produce motion in the locomotive engine, and which description is rather suited to the school-room than the workshop, Mr. Baker delivers himself as follows:—"Such is the modern locomotive engine—an illustrative example of the genius of man; but, like other important inventions, it is the joint production of many minds, and many more are directed to its further improvements. The records of the Patent Office show that from January, 1840, to the end of September, 1849, no less than 226 patents were enrolled, all of them more or less applicable to the steam-engine and its appendages. Of these 226 patents, 45 were enrolled during the first nine months of 1849. It has been remarked that steam-engines and railways were too matter-of-fact subjects for poets and painters, but, from the above record, it is evident that they deeply impress themselves upon the inventive intellect of the world; and if the prodigies performed by steam remain unsung, or unportrayed, they dare, if not realise, the very sublimity of both poetry and painting; for what scene is more interesting to delineate than one of these stately machines moving safely along, at eagle speed, the very *élite* of the land, including even royalty itself (!) through districts rich in historical associations of past ages, and at the same time teeming with the great works of Nature and Art (!) Surely it cannot be that the subject is too lofty a one for poetical or pictorial illustration, for in greatness of idea lies the success of both." Thank Providence, the end of the sentence is at last reached, and we hope never to meet with such another ungrammatical agglomeration of the sublime and the nonsensical as is involved in it—at least, not in the pages of a scientific volume. Mr. Baker will do well to confine himself in future to figures arithmetical, and not to attempt those of speech. A new method of showing the positions of slide-valves by geometrical construction, and for which the author acknowledges himself indebted to C. E. Amos, Esq., of the well-known firm of Easton, Amos, and Sons, is given in the treatise, and this has much practical value undoubtedly—for the rest—but possibly, enough has been already said about that.

Solutions of Questions in Arithmetic by First Principles: comprising a Classified Series of Examples in Proportion, Interest, Discount, Stocks, Profit and Loss, Partnership, &c., &c. By Walter McLeod, F.R.G.S., M.C.P., Head-master, Model School, and Master of Method, Royal Military Hospital, Chelsea. London: Longman and Co.

Long before the publication of this work, Mr. McLeod had established for himself a well-earned reputation as an arithmetical authority. That reputation will be enhanced considerably by his little volume of "solutions." It is precisely the book which was wanted in public and private schools, and, for the sake of pupils in both, we trust that it may be extensively adopted therein.

The author boldly leaves the beaten track of ancient and parrot-like routine, and takes another, and far better course. He not only demonstrates the mode by which arithmetical questions should be worked out, but gives the reasons why they should be so worked. In nearly all our existing text books in arithmetic, examples such as those solved in this manual are worked by statement, according to certain rules which the pupil must learn by heart, before he attempts the solution of a question.

The method adopted by Mr. McLeod, on the contrary, dispenses with rules altogether, and multiplication and division are the only agents used, besides intelligible explanation. It is evident that by such processes the scholar will become something more than a merely mechanical cipherer. He will understand what he is doing, and thus rise to the position of an intelligent agent.

As a sample of Mr. McLeod's explanatory method, we append his definition of bank discount:—"A note or bill is said to be discounted when a bank receives it, and pays to the holder what remains after deducting from the note or bill the legal interest upon it until it becomes due. The interest which is deducted from the note or bill is termed the bank discount. The bank discount, therefore, is the simple interest of the bill paid in advance. Thus, let a bill be drawn for £105 and have a year to run, and let it be discounted at five per cent. The true present worth should be £100, because this sum, bearing interest at five per cent., will, at the end of a year, be worth £105; but the discount deducted for cashing such a bill is £5 5s.; its present worth, therefore, is only £99 15s., which is five shillings less than the true present worth, so that the holder of the bill loses, and the banker gains, the loss being *the interest upon the true discount.*"

Mr. McLeod draws questions from the works of other eminent arithmeticians, as Colenso, Page, and Calder, and solves them in his own admirable manner. As a whole, the work is indeed excellent, and we but perform a simple duty in cordially recommending it to the public.

ON THE RELATIONS OF DEATH TO LIFE IN NATURE

BY J. D. DANA.

1. THE creation of a plant with "seed in itself," as Moses states in his concise description, was the simultaneous institution of life and death. It was the establishment of an in-coming and out-going stream, to be in constant flow as long as the kingdoms of life should last—an incessant renewal of youth, and rejection of age.

All life is a system of progressing changes in cycles—the germ first, then the embryo, the young, the adult, and last, the seed or germ again, to continue the rounds; the adult sooner or later disappearing from the field of progress, and then from the sphere of existence. Death is implied in the very inception of the scheme.

2. Death is also in every step of the process of life. For the living being is throwing off effete matter during all its growth; the change is constant, so that with each year a large part of the material in our bodies has passed away and been replaced by new. Moreover, the force which had been expended in making a cell, or particle of tissue, goes to form a new cell or particle when the former dies, and was needed for the new formation going on. Force is not lost or wasted, but used again. There is unceasing flow, and in this flow is life; its cessation is death.

3. The kingdom of plants was instituted to turn mineral matter into organic, that the higher kingdom of animals might thereby have the means of sustenance; for no animal can live on mineral matter. Now this living of animals on plants implies the death of plants.

Again, the rocks of the globe are, to a great extent, made of the remains of dead animals.

4. The chemistry of life, also, required death. Life in the plant or animal, if sustained by means of nutriment, and continued consuming, with no compensating system, would evidently end in an exhaustion of any finite supply. A perfect adjustment was therefore necessary, by which nutriment should sustain life, and life contribute to nutriment. Now, the plant takes up carbonic acid from the atmosphere, appropriates the carbon, and gives back the oxygen. Yet there is no tendency to an exhaustion of the atmospheric carbonic acid, or an over supply of the oxygen; for death strikes an exact balance.

The death of the plant ends in a change of all its carbon into carbonic acid again. Thus the plant, as it grows, decomposes carbonic acid to get carbon, and then ends in making, by its decay, as much carbonic acid, and restoring it to the atmosphere. Thus, through death, the compensation is perfect. The atmosphere loses only what it receives. Again, as just now observed, the plant, in growing, gives oxygen to the atmosphere; but in the decay of the plant, the carbonic acid formed is made by taking up the same amount of oxygen. The same carbon that lost oxygen when becoming a part of the plant, takes it again at the decay. The system is hence complete. The parts play into one another in perpetual interchange. Take death and decay out of the system, and it would not work.*

Animal life, as above stated, was made to subsist on plants. But the scheme is so well managed as not to disturb the balance made by the vegetable kingdom alone. For all the carbon of animals comes from plants. The plants which feed an animal, and which, on decay, would have turned into carbonic acid, become changed into carbonic acid in the course of the growth of the animal, so that the whole amount of carbonic acid which the animal makes, is only what the plants would have made if left to natural decay. Thus the higher kingdom of life is introduced and sustained, and yet the balance remains undisturbed. The system is perfect.

5. Again, one part of the animal kingdom, through every class, is made to eat up the other part, or at least live on it. The flesh-eaters are of all grades, low and high, from the infusorium and maggot, to the lion and man. Some take what is already dead, or decomposing; others kill and eat. On this subject we observe:—

(1.) Death is in the system of nature—death from earthquake, lightning, and all moving forces, as well as by natural decay; and the creation of carnivorous animals was hence in harmony with the system.

(2.) Various noxious animals are held in check by the carnivorous species.

(3.) By means of flesh-eaters, the diversity of animal species subsisting on a given amount of vegetation is vastly increased, and a wider expansion is given to the animal kingdom.

(4.) Putrefaction of the dead is prevented by a multitude of scavengers, who, at the same time, turn the flesh into food for the vegetable kingdom; and thus plants feed animals, and animals feed plants—one of Nature's circles again.

The last two principles mentioned are of profound importance. The vegetable kingdom is a provision for the storing away or magazining of force for the animal kingdom. This force is acquired through the sun's influence or forces acting on the plant, and so promoting growth; mineral matter is thereby carried up to a higher grade of composition, that of starch, vegetable fibre and sugar, and this is a state of concentrated or accumulated force. To this stored force animals go, in order to carry forward their development; and, moreover, the grade of composition thus rises still higher, to muscle and nerve (which contain nitrogen in addition to the constituents of the plant), and this is a magazining of force in a still more concentrated or condensed state. There are thus five states of stored force in nature—three in the *inorganic*, the solid, liquid, and gaseous; and two in the *organic*, the vegetable and animal.

Now what is the provision to meet this last and highest condition? Is this magazined force left to go wholly to waste by the death and decomposition of the plant-eaters? Just the contrary: an extensive system of flesh-eaters was instituted which should live upon it, and continue it in action in sustaining animal life among successive tribes. The flow is taken at its height, and the power is employed again and again, and made gradually to ebb. What is left as the refuse is inorganic matter—the excremented carbonic acid, water, and excrements, with bones or any stony secretions present. Thus the flow starts at the inorganic kingdom, and returns again to the inorganic. Moreover, in the class of quadrupeds (mammals), the flesh of the herbivores (cattle) is among the means by which the animal type is borne to the higher grade of the carnivores. The true carnivores, besides, take the best of meat. Whales may live on the inferior animals of the sea; but the large forest flesh-eaters take beef and the like.

There is another admirable point in this scheme. The death and decomposition of plant-eaters would have rendered the waters and air, locally at least, destructive to life. It is well known that it is necessary in an aquarium to have flesh-eaters along with the plant-eaters and plants. And when in this way the living species are well balanced, the water will remain pure, and the animals live on indefinitely. If not so balanced, if an animal is left to decay, the waters become foul, and often everything dies. Putrefaction and noxious chemical combinations follow death, because, in life, the constituents, carbon, hydrogen, nitrogen, and oxygen, are in a constrained state, at the furthest remove from what chemical forces alone can produce; and hence, when the restraint is taken off at death, the elements fly into new conditions, according to their affinities. Now animals, dying yearly by myriads, are met at death by an arrangement which makes the dead contribute anew to animal life as its aliment, and in this very process the flesh ultimately comes out innocuous, and is at last so far changed to the inorganic condition as to be the best of fertilizers for plants. Part of the process of getting rid of the great fleshy carcases consists in their minute subdivision by the feeding of larves of insects, and, furthur, an infinitesimal division of the insect as the food of the infusoria,—which again may become the nutriment of larger animals, to go the rounds once more. But the final result is, as stated, *plant-food*—largely through the processes of digestion and excretion, but part through the decomposition of animals that are too small and readily dried up to prove offensive.

Thus the carnivorons tribes were necessary to make the system of life perfect.

One word respecting the necessity of a check on the excessive multiplication of individuals. Nature, as just now observed, is a system of constantly varying conditions—of changing seasons, winds, clouds: of inconstancy, under law, in all forces and circumstances. At the same time, the growth of a species requires the nicest adjustment of special conditions in each case. On this account the reproductive powers in species is, in many cases, excessively large, so that the various accidents to which the eggs or young would be exposed, might not cause their extermination. This provision opened the way for occasional excessive multiplication, and required a check from carnivorous races.

6. Finally, could death be prevented in a system of living beings in nature without a constant miracle? How should the earth be managed to secure it against death? It would be necessary to still the waves, for they are throwing animals and plants on the coast to die; to still the winds, for they are ever destroying in some parts of their course; to still even the streams and rains. With winds and waves, not only helpless animals and plants, but men's houses, ships, and boats, would now and then be destroyed, in spite of prudent precaution and holy living. But if we still the waves, the winds, and the streams, the earth would rot in the stagnation, and here again is death!

We thus learn, that in life the fundamental idea of reproduction implies death; the processes of life are the processes simultaneously of death; the stability of the system of life requires death; the vegetable kingdom is made to feed animals, and the animal kingdom, while containing plant-eaters, demands flesh-eaters for its own balance, for the removal of the dead, and to make out of dead flesh the proper food for plants, thus to pay its debt to the vegetable kingdom. Hence death pervades the whole system of life in its essence and physical laws; and it could not be prevented in a world of active forces except by a constant miracle; and this would be an annihilation of nature, that is, a system of law.—*Silliman's Journal of Science and Arts.*

THE LATE MR. RICHARD GREEN.

LESS than twelve months ago the shipping interest lost a valued friend in the person of the late Mr. Dunbar. It is now our painful duty to announce the decease of the eminent shipowner and builder, Mr. Richard Green, which took place at the residence of his sister, in Regent's-park, on the 17th inst., he having just completed his 59th year.

Mr. Green was the owner of a magnificent fleet of more than 30 ships, none of which is less than 1,000 tons, trading to India, China, and Australia. He employed, on the average, 600 artificers and labourers in his dockyards, and more than 1,200 officers and seamen afloat.

As a shipbuilder Mr. Green was averse to innovation. He never could be persuaded to construct iron vessels, although the last two launched by him—the "Renown," and "Shannon," respectively of 1,450 tons—were furnished with iron beams or girders. Perhaps this resolution was the result of the failure of the screw as an auxiliary, which he, many years ago, adopted in the "Vernon" and "Earl of Hardwick;" but subsequently abandoned, partly in consequence of the space taken up by the machinery and fuel, and partly by the damage the vibration caused to the cargo.

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* In early geological history, as is generally believed among geologists, there was an excess of carbonic acid in the atmosphere; and this excess was removed to a great extent by the growth of plants during the carboniferous era. Vegetable material decaying under water does not undergo complete decomposition, and thus part of the carbon is left behind; and so far as there is carbon left, there is an actual abstraction of carbonic acid from the atmosphere by the process of growth. The coal era was a period of great marshes; and by this means the needed purification of the atmosphere was effected, preparing it for land life. The amount abstracted now by the same means is very small, and may be balanced by the carbonic acid from mineral sources and volcanoes.

Mr. Green identified himself closely with the Naval Reserve, and took unwearied interest in its formation and efficiency. He instructed his own officers and men to enrol themselves in the force, and, such was the influence he exerted, that most of his officers hold commissions in that important auxiliary to our maritime power. One of his last acts was a petition to the Board of Admiralty for the permission of merchant ships, where the captain is a lieutenant, the mate a sub-lieutenant, and one fourth of the crew are men of the Royal Naval Reserve, to fly the blue ensign. This petition was before the board when Mr. Green's death took place, and the Duke of Somerset, out of respect to the memory of one who took so much interest in the maritime defences of the country, has since granted the request.

Mr. Green did much to elevate the profession of the mercantile marine. All his officers were carefully selected from the educated classes, and his care for seamen is shown by the fact that he, many years ago, purchased "The Sailors' Home" from his father, and has ever since, not only liberally supported it, but taken a most active part in its management. He highly approved of the regulation for the payment of ships and shipping hands under the Merchant Shipping Act, and let part of the "Home" to Government for that purpose.

Mr. Green was treasurer to the Merchant Seamen's Society, a warm patron of the Poplar Hospital, a zealous supporter of the "Dreadnought" hospital ship, and was chairman of the Training School for the Merchant Navy, conducted on board H.M.S. "Worcester." All these institutions have lost in Mr. Green a wise counsellor, an able advocate, and a liberal benefactor. To the whole of them he has made large bequests, that to the "Dreadnought" being one thousand pounds.

Mr. Green always regarded the interests of seamen as objects of peculiar regard.

Lord Clarence Paget was his intimate friend, and he was frequently solicited to enter the House of Commons in the cause of Liberalism, but his delicate health and multifarious engagements always led him to decline the honour.

His death was the result of general debility—the over-working of mind in a body never robust. He was interred, on the 24th instant, in the grounds of Trinity Church, Poplar, which was built by his father, and was followed to his final resting place by a large concourse of surviving friends, the respect shown being universal throughout the district.

Mr. Green was never married, but it is gratifying to know that so large an establishment will be steadily carried on by his brother, Henry Green, Esq., Captain Toller, formerly in his service, and Captain Wight, who remained in his employ; these three gentlemen being appointed his executors.

EDDINGTON'S PATENT DRAIN PLOUGH.

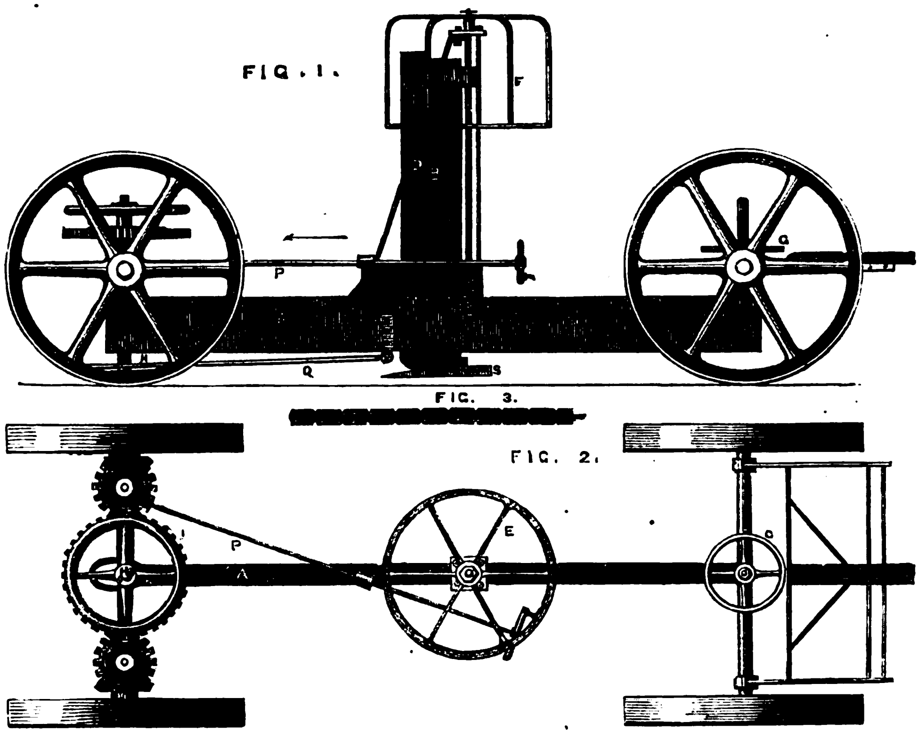


FIG. 1.

FIG. 3.

FIG. 2.

EDDINGTON'S PATENT DRAIN PLOUGH.

A PATENT has been obtained by Mr. W. Eddington, of Chelmsford, for a new plough for draining land. The invention consists in connecting the fore part of a draining plough to the axle by means of a screw and nut, or otherwise, in such manner that the mole can be raised or lowered as the plough travels along, and thereby enabling the drain to be made level, or at a given incline, independently of the unevenness of the surface of the ground, which can be effected by turning a screw or nut by means of a wheel or handle connected therewith. The screw for raising or lowering the fore part of the plough is in communication with the travelling wheels by suitable gearing and clutches, so that the plough and drain may be gradually raised or lowered as it proceeds, whereby to cause a regular fall of the drain on flat lands.

Another part of the invention relates to an improved rope for laying the pipes in the drains made by the ploughs. For this purpose a number of short tubes or sockets of wood are threaded on a small wire or a strong rope, on which the pipes to be laid are strung, which prevents the wear of the rope in passing through the pipes.

Fig 1 of the engravings represent a side elevation; and Fig 2, a plan of a draining plough, fitted and furnished according to this invention.

A A is the beam or frame in which the plough coulter B is fitted, and can be slid up and down for adjustment of depth, being actuated and controlled by a screw, C, supported from the beam A by framework or stays, D D, supporting it at top. The rotation of the screw C, by means of the hand wheel E, operates the nut F, fixed to the coulter B. The rear end of the beam is supported from the hind axle by a screw fixed in the beam passing through the axle, and having on it a hand wheel and nut G, by which it may be raised or lowered, and the position of that end regulated as desired. The fore end is furnished in a similar manner, but in that case the screw H is received in a nut secured to the beam A. On the screw H is fixed a spur wheel I, and hand wheel K, to operate the screw by hand if desired. On the naves of the fore wheels are fixed bevel pinions, taking into other bevel pinions, mounted on studs, fixed to the fore axle; above the latter wheels are spur pinions, geared in with the spur wheel I, fixed in the screw H, at pleasure. P is the steering apparatus, which operates by simply inclining the fore axle in the direction of travelling, as well understood; and Q is the traction bar, to which the traction rope is attached to draw the plough over the ground; S is the mole which forms the passage for the drain or drain tiles, and to which the rope for drawing the tiles is attached.

Fig. 3 represents a portion of a rope, as described under the second head of this invention.

KEELING'S GAS APPARATUS.

A PATENT has been obtained by Mr. J. Keeling, of Reading, for an apparatus for the manufacture of gas. The apparatus consists of an oblong box made of cast iron, or other suitable material, divided into three principal chambers, as illustrated in the annexed engravings; the first, A, fig. 2, serving as a tar cistern; the second, B, a condenser; and the third, C, a purifier. The carbonization of the coal or other gas-making material being effected in the ordinary manner, the hot gas is conveyed by a pipe, D, into the first chamber, where, upon entering an enlarged space, and meeting with the comparatively cold tar, liquor, or water contained in the bottom, the temperature of the gas is considerably lowered, the consequence of which is, that much of its tar and ammoniacal liquor is there deposited. As, however, it is not sufficiently cooled to enter the purifier at once, it passes on by a pipe, E, into the second chamber, B, the upper part of which is subdivided into a number of secondary wedge-shaped compartments communicating with each other, the inlet to each being larger than the outlet, in the proportion of two to one, so that when the gas enters the first compartment it enters freely, but as it makes its exit, the outlet being smaller than the inlet, its passage is retarded; and as this same action occurs every time it passes into a fresh compartment, it is thereby compelled to linger while passing over the cooling surfaces of the condenser and water contained therein, and by this means is made to deposit more completely the remaining tar and ammonia hitherto held in suspension. The peculiar unsteady motion given by the hydraulic main to the gas, and by it transmitted to the water, is here taken advantage of, and assists in the more effectual separation of these impurities. An important feature in these improvements is, that whatever deposit takes place in the condenser, almost the whole of it will fall to the bottom, from whence it may be drawn off at the cock, all chance of the gas way becoming choked up is thus removed.

The manner in which these compartments are constructed will be better understood upon reference to fig. 1, which represents the cover of the first and second chambers, attached to which are a number of plates, G, cast perpendicular to it.

These plates slide into vertical grooves formed in the sides of the second chamber, and by means of cement are made into so many secondary compartments, the form and disposition of which will at once be seen. The gas being sufficiently cooled, now enters by the pipe, H, into the purifier, where it is freed by lime, oxide of iron, or other purifying agent from its sulphuretted hydrogen, carbonic acid, and other impurities. From thence it passes off by the pipe, I, to the gas-holder. In addition to the ordinary water lute for the cover of the purifier, and for the greater security of making gas on shipboard, or other situations in which by the oscillation of the vessel the water might be ejected, it is intended to form the bottom of the cover with a flange, between which and the bottom of the lute an india-rubber packing is to be placed, and the whole secured so as to form a gas-tight joint by means of cross bars and screws. And as oxide of iron is the most suitable material known for the purification of gas manufactured in such situations, from its property of being revivified by communication with the atmosphere, it is proposed to connect a goose-necked pipe with the purifier, through which air may be blown whenever revivification is necessary, such pipe having a cock at bottom, and to be charged with water when not in use. The removal of the cover of the purifier may be thus dispensed with. These modifications, however, are not shown in the engravings, a description being considered sufficient. In order to prevent the accumulation of liquid in the second chamber to an inconvenient height, an overflow pipe is attached thereto, which communicates with the first chamber, into which it descends in the form of a syphon, which, while allowing any superfluous liquid to flow off, is effectually closed against the gas. K is also a syphon, serving as an overflow pipe for tar and ammoniacal liquor; L is an orifice, through which the second chamber is filled with water, and is fitted with a screw plug. Should it be deemed desirable to take out the whole of the ammonia from the gas, sulphuric or other suitable acid may be mixed with the water contained in the middle chamber, but in such case it will be necessary to line the interior with lead or other material capable of resisting the action of the acid.

KEELING'S GAS APPARATUS.

FIG. 2.

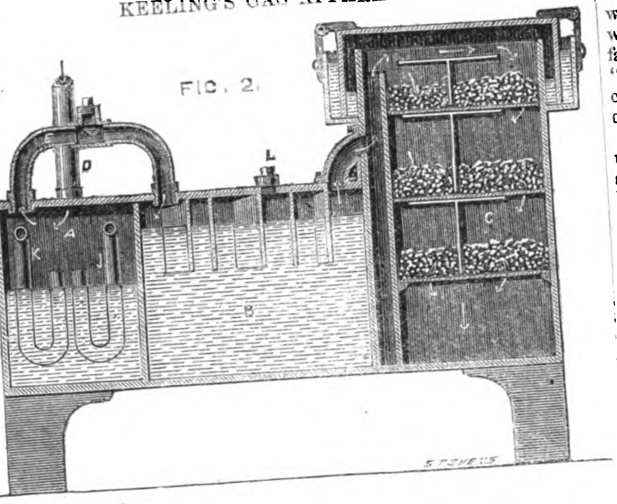
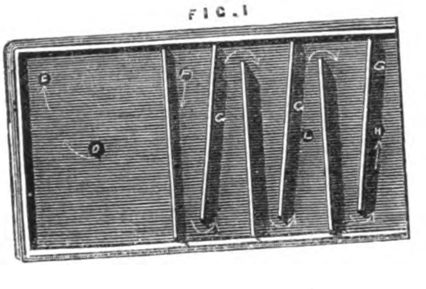


FIG. 1

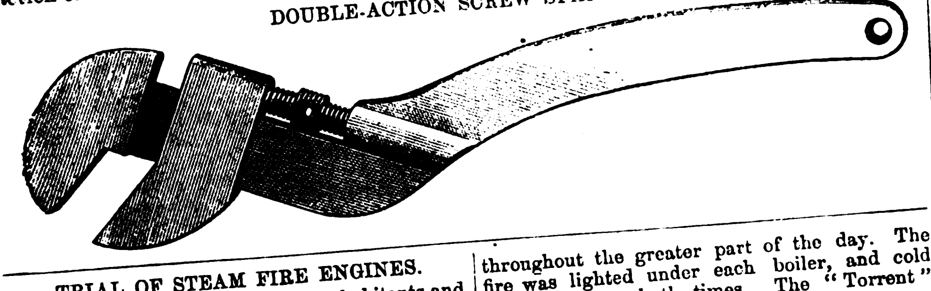


DOUBLE ACTION SCREW SPANNER.

Mr. Thomas Wilson, of Birmingham, has just patented an invention for a new spanner. The superiority of this spanner consists in the novel and rapid mode of its adjustment, by a double action screw, and in its useful and convenient arrangement of curved handle and oblique jaws.

For machinery and jobbing purposes, and particularly for special use in awkward and other situations, it is valuable, its curved handle and oblique jaws giving it, in addition to its other advantages as a moveable spanner, all the facilities of a cranked wrench, which, with its double action screw, can be rapidly adjusted to its work.

DOUBLE-ACTION SCREW SPANNER.



TRIAL OF STEAM FIRE ENGINES.

On Thursday, the 15th inst., the inhabitants and proprietors of the several large manufactories about West Ham, Bow, and Stratford, had an opportunity afforded them by James Kayess, Esq., of the West Ham Abbey Print Works, of seeing the improvements which Messrs. Merryweather and Son have effected in steam fire-engines. Two engines were tried—one, the "Deluge," which was in the International Exhibition, and which, since its return from there, did good service at the large fire near Blackfriars-bridge; the other engine, by the same manufacturers, just completed, and named the "Torrent," is of a class termed "light steam fire-engines." The engines were worked at 9.30 a.m., and again at 3 p.m., and were at work throughout the greater part of the day. The fire was lighted under each boiler, and cold water used at both times. The "Torrent" raised steam to 90 lb. pressure in 12 min. 10 sec., and the "Deluge" 50 lb. of steam in 12 min. 10 sec. Each engine starting to work at those respective pressures. The "Torrent" threw a 1⅛ inch jet well over a chimney 120 ft. high, although the wind was blowing stiff, and afterwards worked on the building, with great force, through 1¾ inch and 1⅞ inch nozzles; from the effective manner in which these jets were delivered, it was very evident that 2⅛ inch jets could be powerfully projected; and 1¼ inch jet was also delivered with very good effect. The "Deluge" threw the water nearly half as high again as the chimney, through a 1¼ inch, then a 1⅜ inch and 1½ inch nozzles; 4¾ inch jets were then attached to the "Deluge," and both engines working at one time, six powerful jets of water were delivered on to various points of the factory. From the manner in which the "Deluge" discharged those jets, it was very evident that 4⅞ inch jets could be projected equally as strong.

Both engines were worked at their steady usual speed, as for fire duty, and the raising of steam was not hurried, so as to show what could be done under ordinary circumstances. Either of these engines can be at work in 9 min. from the time of lighting the fire, if required. The "Torrent" has previously raised steam to a working pressure of 37 lb. per square inch in 8 min.

The pump valves of both engines are specially arranged so as not to choke with foul or gritty water, and so that they cannot get frozen. The working parts bear no undue or transverse strain, and are without fly-wheels. The frames are of wrought iron, and fitted for the roughest travelling without sustaining injury. Among the gentlemen present were:—W. Duncan, Esq., water engineer; Major Greig, head constable; and Mr. Henritt, superintendent of fire police, Liverpool; also Captain Strange, Mr. White, superintendent of the Gravesend police; C. F. Young, Esq., C.E.; Mr. White, of the County Fire Office; Mr. W. Baddeley, &c.

THE NAVY AND THE FRENCH EMPIRE.

Last week we indicated the character of an important letter communication, by Mr. Donald Mc'Kay, on the French Navy. We now give the entire letter, which we extract from the *Boston Commercial Bulletin*. Mr. Mc'Kay is a high authority on naval matters in the United States, and his words are worthy of mature consideration by the authorities of this country. The letter is as follows:—

Paris, Nov. 30, 1862.

Mr. Editor,—I promised you a full report on the state of the French Navy, and having again visited their dockyards and arsenals, I am happy in being able to give it to you. Although I had the Ministerial permission to visit all the dockyards of the Empire, yet I found the greatest difficulty in obtaining the permission of the admirals commanding the different stations, but at last I succeeded.

APPROPRIATIONS.

In the year 1855, a commission, composed of the most able men of each department of the French navy, considered the organisation which it would be proper to give to the Imperial navy, and a report of the Minister of Marine, approved by the Emperor, contains a complete list of the ships composing the French navy, with the strength of each ship in guns and horse power, and no doubt this report is in the hands of our Government.

The same report gives also the number, and strength in guns and horse power, of the ships which are to be built from year to year till 1870. The credits necessary to carry out these plans were voted in 1857, and the plan fixed upon was then to be executed and accomplished in 1867, at each time the French navy was to be composed (besides a large number of ships of inferior classes) of

Screw line of battle ships of first class …………	15
Ditto second class ……	25
Total ………………………………	40

IMPROVEMENTS.

Since then experience has pronounced in favour of iron-cased frigates, and it has been decided by the Imperial Government that the plan fixed upon in 1855 is to be carried out to the letter, with the difference of putting iron-cased frigates instead of line-of-battle ships.

This transformation of the French navy (if war should not accelerate the progress) will be completed in 1870, and the principal fighting parts (for aggressive purposes) of the French fleet will consist at that time in 40 iron-cased frigates of the first class, varying in armament from 36 to 52 guns (all rifled and breech loading), having a horse power of from 900 to 1,200, and all possessing a superior speed, exceeding 12 knots per hour.

Whatever improvements may be made in the meantime in naval architecture, the same plan will be carried out with such slight modifications as well stated and tested experience will show it to be desirable and necessary to adopt, in order to always secure to France the rank of a first naval power.

After all that I have seen, it is my firm conviction that France is the first naval power on the globe, and further, that no other power will possess, at the end of another year, a fleet capable to cope successfully with the French iron-cased fleet on the open sea.

ESTIMATE OF EXPENSES.

The estimate of the French navy expenses, for the year 1863, is as follows :—

	Francs.
SECTION 1.	
Central administration (personnel)	1,059,900
,, ,, (materials)	267,300
Council, general inspection and control	485,777
	1,812,977
SECTION 2.	
Pay of officers and crews	27,335,806
,, marine troops	8,652,810
Different administrations and agencies	5,953,725
Pay of masters, leading men, watchmen	2,766,012
Hospitals	2,254,658
Victuals	13,748,900
	60,411,911
SECTION 3.	
Pay of workmen in the yards	17,000,000
General stores for the fleet	34,954,000
Hydraulic works and civil buildings	8,012,000
Powder	475,412
	60,441,412
SECTION 4.	
Maritime tribunals	147,560
Naval schools and pursers of the navy	210,000
Hydrographic and scientific service	400,000
Purchase of books and cost of printing	489,400
Travelling and different expenses	2,277,660
Temporary expenses	100,000
Convicts	128,000
	3,752,620
SECTION 5.—COLONIES.	
Civil and military service	14,481,600
Materials (civil and military)	3,044,500
Penitentiary service (Guyane)	4,942,800
Local service	2,223,500
	24,692,400
Total of estimated expenses for the navy and the colonies	151,111,320

These estimates have already been found to be not sufficient to cover the probable expenses of the navy in 1863, and therefore an additional grant has been made to cover the expenses. This grant is added to section 3, and allows for

	Francs.
General stores of the fleet	12,500,000
Hydraulic works and civil buildings	4,500,000
	17,000,000

In this additional grant are included for

The purchase of timber	1,500,000
,, ,, iron	3,000,000
For construction of ships in private establishments	2,000,000

The latter items give proof of two facts:—That the French Government continues to give the preference to wooden, and against iron ships, and therefore intends yet to increase its already immense stock of timber; and that the iron-cased ships are to be completed with greater rapidity than was originally contemplated. Therefore the large additional grant for the purchase of iron. I am confirmed in this view by the order given a short time ago, by the Minister of Marine, to complete all the iron-cased ships on the stocks by the middle of next year. With the present relations existing between France and the United States, this fact is of high importance, and looks rather ominous.

To return to the estimate, we find that all the grants for the navy for 1863, deducting those for the colonial service, amount to 143,418,920f., being twenty millions of francs in excess of the Naval Budget for 1860.

The sums allowed for the purchase of the principal materials for naval construction, use will be found in the following table :—

	Francs.
Timber (transportation not included)	6,450,000
Iron and metals of all kinds	10,821,000
Hemp, rope, saileloth, oakum, &c.	2,520,000
Pitch, tar, oil, tallow, soap, &c	2,200,000
Coal and combustibles (transportation not included)	3,100,000
Cloth, woven articles, &c.	250,000
Different articles	325,000
Total for purchase of materials	25,666,000
For purchase of steam engines and all kinds of ready-made stores (from private industry) for naval construction use	10,215,000
Construction and repair of ships in private establishments	4,100,000
Total cost of transportation of material to the naval arsenals	3,710,000
The estimated expenses of the material for the artillery of the navy amount to	2,400,000

The large amounts granted for the purchase of rough material, notwithstanding the immense amount of stores on hand, show the intention of the French Government to be prepared to meet the possible exigencies of suddenly increased armaments.

STEAM NAVY OF FRANCE.

The steam navy of France at the present moment, November, 1862, is composed as follows :—

Class.	Afloat.	Building.	Total.
Line-of-battle ships	36	1	37
Iron-cased frigates	6	10	16
Screw frigates	25	4	29
Paddle ,,	18	—	18
Despatch boats (screw)	35	1	36
,, ,, (paddle)	88	5	93
Iron-plated floating batteries	14	7	21
Gunboats	53	5	58
Transports	34	9	43
Total	325	42	367

SAILING NAVY OF FRANCE.

The sailing navy of France consists at present of:—

Class.	Afloat.	Building.	Total.
Ships of the line	7	—	7
Frigates	23	—	23
Corvettes	12	1	13
Brigs	19	2	21
Small vessels	26	—	26
Transports	32	—	32
Total	119	3	122

STOCK OF MATERIAL ON HAND.

To make it possible for the French Government to carry out the plan for the transformation of the navy, notwithstanding a long war preventing the importation of all kinds of material necessary for the construction of ships, the stock of iron, timber, and coal has been increased by one half over the amounts fixed by the navy regulations to be kept on hand. Thus the stock of timber on hand is sufficient for a 7½ years' consumption; that of masts for a 30 years' ditto; that of small masts for a 10 years' ditto; that of iron for a five years' ditto; that of copper for a five years' ditto; and almost every other article in similar proportion.

It is to be borne in mind that a year's consumption is assumed to be equal to the wants of the navy in the course of its regular development. The last official accounts of the stores on hand are dated January 1, 1861. They are contained in the "Compte général du matériel de la Marine," a work very difficult of access. Since that time the stock has been largely increased, but I will give you the correct amount at that date.

Stock of material on hand in the French Navy yards in January, 1861; also comparison with the stock required to be kept on hand by navy regulations:—

ON HAND JAN. 1, 1861.

Timber.	Unit.	Reglementary.	French Measure.	English Measure. tons of 40 ft.
Oak of all kinds	*Stere.	171,000	249,793	224,814
Pine and resinous timber	,,	74,000	66,692	61,023
Masts	Number.	15,000	15,298	—
Spars	,,	10,000	8,190	—
Hand masts	,,	25,000	27,759	—
Elm	*Stere.	—	8,821	7,939
Other kinds timber	,,	12,000	4,240	3,816

ON HAND JAN. 21, 1861.

Metals	Unit.	Reglementary.	French Measure.
Cast iron	Kilogram.	—	23,010,692
Wrought iron	,,	10,800,000	23,706,582
Iron plates	,,	4,000,000	5,260,873
Steel	,,	—	769,869
Sheet iron	Number.	300,000	137,104
Copper	Kilogram.	—	3,479,500
Sheet copper	,,	2,940,000	540,327
Lead	,,	1,500,000	1,129,246
Tin	,,	—	111,091
Zinc	,,	—	544,319
Hemp	,,	3,000,000	1,921,468
Oakum	,,	—	280,161
Sailcloth	Metre.	2,150,000	1,639,308
Bunting	,,	—	62,146
Tar, rosin, pitch, &c.	Kilogram.	—	830,631
Oil of all kinds	,,	—	647,365
Candles, tallow, waste, and soap	,,	—	326,468
Coal for steam-boats	,,	—	83,867,928
Burning wood, charcoal, &c.	,,	—	9,546,695

The stock of timber, particularly oak, on hand in the French arsenals, is without doubt the finest ever selected. The arsenal of Toulon alone contains upwards of 65,000 tons of the choicest oak timber, mostly procured from the Romagna, the Island of Sardinia, from Burgundy, and the south of France. About 20,000 to 25,000 tons of this quantity are kept in salt water, mixed with fresh, and the remainder is kept in storehouses constructed of solid masonry, and which together have a length of more than a mile and a half. Large as these are they are not sufficient for the wants of the navy, and the whole boundary of the establishment at the Mourillon is being encircled by one building of about a mile in length, intended solely for the storage of timber. This circumstance proves that in France, where the question of iron-cased ships has been very closely studied, the highest authorities of the naval service have come to the conclusion that for sea service the preference has to be given to wooden iron-cased ships, and in general to wood-built ships instead of iron ones.

WOOD VERSUS IRON.

Of the sixteen iron-cased frigates which France possesses afloat and in construction, only two, the "Couronne" (afloat) and the "Heroine" (on the stocks), are built of iron, and it is now regretted by the Government that they were not constructed of wood, for experience has already proved, and without any contradiction, that these vessels, on account of their rapidly fouling bottoms, will not be capable of keeping up in speed with the wooden built and coppered frigates. The "Warrior," of the English fleet, has lost from this cause two knots of her original speed, and it is generally conceded that these iron-built men-of-war ships will have to be taken into dock at least every three months to clean their bottoms. The pirate ship "Alabama" — which by her superior speed defies the whole United States' navy, and which actually keeps up a partial blockade of our Northern ports—is a striking example how the advantages of timber built ships for speed are even recognized in an iron country like England. Well knowing that her safety would lie in her superior speed on a long cruise, Mr. Laird, of Birkenhead, the iron-ship builder, has built this ship expressly of timber, with coppered bottom. I regret to have to state my firm conviction that we do not posses in our navy a single ship which is capable to cope with her in speed. This is the consequence of Government never having trusted to private constructors for the production of superior models for our navy. Vessels of high speed are what we want, but which we never shall possess unless a different course is adopted by our navy department.

The French at the present time have the following iron-cased frigates afloat:—

The "Gloire," "Invincible," and "Normandie," built of timber, and all from the same lines, by Mr. Dupuy de Lome; the "Couronne," built of iron, after plans of Mr. Audenet; and the two ram ships "Magenta" and "Solferino," built of timber after plans of Mr. Dupuy de Lome. The thickness of the iron casing in all these ships, as well as in those on the stocks, is the same—4¾ in. near the load line and 4¾ above that. The first three named ships have been already thoroughly

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* A stere is equal to a metre-cube, or about 36 cubic feet.

tried at sea, and they are a perfect success. They have attained the superior speed of 13¼ knots, under steam alone, with men and armament on board. They roll easy, and do not pitch more than is usual. I have been on board of the frigate "Invincible," thoroughly examined her, and found that she has not strained in the least (as was reported)—that she is perfectly tight, and her ventilation is the best I ever met with in any ship, the air being pure throughout. The captain assured me that the ship steers like a pilot-boat, and that she never strained or leaked, and is an excellent sea vessel. All the appliances on board of these frigates, to make them real, efficient fighting ships, are admirable and ingenious.

The 10 frigates on the stocks are similar to the "Gloire" in their general outlines, but they are of a far superior model, will have easier motions, be faster still and carry their battery 14 in. higher. I think their shape could yet be improved upon; but, such as they are, I consider them to be the most efficient men-of-war ships yet laid down by any nation. Their principal dimensions are:—Length, about 265 ft.; breadth, 56 ft.; mean draft, 25½ ft.; and will render themselves always easily managed ships, obeying the rudder quickly; and they possess, in this respect, immense advantages over their over-large and overlong English adversaries, which, on account of their exaggerated dimensions, are almost unmanageable.

I regret very much to see, from the late accounts received from the United States, that our Government intends to construct a number of iron iron-cased ships (cruisers) of 7,300 tons each. How such a plan could be adopted, with the English experience of such large iron ships before our eyes, is more than I can understand. The comparatively small draught of water which these ships only can have, on account of the depth of our harbours, prevents a possibility of giving any great speed to such immense structures, and their necessarily immense length will render them less manageable yet than their English sister ships. Thus they will be at the mercy of a much smaller opponent, whose superior steering powers allows a choice in position.

The construction of such vessels would be as great an exaggeration as was the construction of a whole fleet of "Monitors," which, I know, will be acknowledged, are only fit for harbour defence, and which leave our navy of sea-going ships just as it was before we commenced the construction of iron-cased ships.

SEA-GOING QUALITIES OF IRON-PLATED VESSELS.

The fact of the safe arrival of the iron-cased frigate "Normandie" at Vera Cruz has dispelled all doubts that were expressed with regard to the possibility of iron-cased ships crossing the Atlantic. She is wooden built and coppered, performed admirably, and proved to be an excellent sea vessel; she rolled comparatively easy, and will, after lying four months at Vera Cruz, have preserved her original speed of 13¼ knots, while an iron-cased ship (like the "Couronne") would in the same time, from a foul bottom, attain a speed of no more than 8 knots per hour. This was the reason that the "Normandie" was substituted for this expedition instead of the "Couronne," which ship had already had orders to proceed to Vera Cruz. The "Gloire" and her sister ships, and also the "Couronne," have engines of 900-horse power, and are armed with 36 rifled 30-pounder guns throwing, shot of 70 lb weight, but breech-loading rifled 30-pounders are being substituted.

IRON RAMS.

The two ram frigates "Magenta" (at Brest) and "Solferino" (at L'Orient) are built on entirely different principles. The bow of these ships is admirable for the purpose designed. If their upper battery were removed, and the lower one plated from stem to stern, in my opinion they would be the most formidable vessels in the world. Up to the first battery these ships are plated from stem to stern, but in the upper battery only 12, and in the lower battery only 18 guns are protected by iron casing. The four rows of iron casing are 4¾ in. thick; the upper ones, 4½. Both ships are being built of timber, and I therefore consider it a bad plan to have left their extremities unprotected. Their shape and interior arrangements are almost perfect.

Their engines are 1,000-horse power; speed 13½ to 14 knots; armament consists in fifty-two 30-pounder rifled guns, on two decks. The "Magenta" is now ready for sea. The "Solferino" was making her machinery trials when I was on board, and she will be ready for sea before the middle of December.

IRON-CASED FRIGATES.

The names of the ten iron-cased frigates on the stocks are "Provence," "Savoie" and "Revauche," at Toulon; "Guienne," at Rochefort; "Heroine" (of iron) and "Surveillant," at L'Orient; "Gauloise," "Magnanime" and "Valeureuse," at Brest; "Flandres" at Cherbourg. These ships are all built from the same lines, and after the same plans. They are built exceedingly strong, and the materials used in their construction, as well as the workmanship, cannot be surpassed. Their engines (almost finished) will be of 1,000-horse power, and they are expected to realise a speed of 14 knots. Their armament will consist of 38 breech-loading rifled 30-pounder steel guns, throwing shot of 180lbs. weight, with which the stoutest armour plates have been penetrated at 600 metres or 660 yards distance. A considerable stock of these guns is on hand at L'Orient.

Work was progressing rapidly on the "Provence," "Flandre," "Guienne," "Heroine" and "Surveillant." The "Provence" will be launched in December. The other four ships can be completed before April next. All their beams were in, and they were ceiled and partly planked. The ribs and beams of the "Heroine" were in place, and the four lower streaks of plates were rivetted on. The remaining five frigates on the stocks all stood in frame, and with their beams in and partly ceiled, and can be completed if necessary before next June.

Thus France will have afloat by middle of next summer 16 iron-cased frigates superior in shape, speed, and steering powers to those of any other nation.

OTHER VESSELS.

Besides the iron-cased frigates, I found in Toulon on the stocks the "Tarne," a large three-decked steam-transport frigate of 500-horse power; also four second class screw gunboats on an improved design—six feet draught of water. At Cherbourg and Rochefort, two other large steam transport frigates are building. At Brest, two twenty-two gun frigates. At L'Orient, a gunboat. All these vessels are built of timber.

PRIVATE ESTABLISHMENTS WORKING FOR GOVERNMENT.

The private establishments are executing many orders for the Government. Mr. Arman, in Bordeaux, is building four light draught iron-cased floating batteries, from plans of Mr. Lemoine, in L'Orient. They will be plated with 6-inch iron throughout, and their armament is to consist of eight 180-pounder steel guns, and they will have two engines each 50-horse power, and be propelled by two screws under the counter. To obtain an exceedingly light draught these batteries are constructed of iron. They are named the "Embuscade," "Imprenable," "Protective," and "Refuge."

At the establishment of Mr. Gouin, at Nantes, three other iron-cased floating batteries are building, named the "Arrogante," "Implacable" and "Opiniatre;" are of iron and light draught; engines are of 150-horse power; and these batteries will be armed with ten of the heaviest guns, of which nine can be used on either side, also three could be used in a chase, or three in retreat. The speed of these batteries will be 6½ knots, which is considered perfectly sufficient. They are entirely different in shape from anything that has been constructed, and are what our Government should have had to take and to hold our Southern ports. The batteries in Nantes are only to be plated near the load line with 4¾ in. iron, and above that with 4¼. All these batteries will be completed by next summer. Several transport frigates, gunboats, and despatch boats are being built in the private establishments of Bordeaux, Ciotat, and Havre.

ENLARGEMENT OF NAVAL ARSENALS, DOCKYARDS, AND WORKSHOPS.

Works for the enlargement of the five naval arsenals are in progress. The dry dock accommodation is also being increased in all the yards. In Toulon, two are completed and the third is excavated, and all are of enormous size. In L'Orient one has been lengthened sufficiently to admit two ships of the largest class at a time. In Brest three are being cut out of the solid rock, and one of them is far enough advanced to begin the mason work. The workshops for the construction and repair of steam machinery in Toulon (at Castigneau) and at Brest are without any parallel for size and excellent arrangement. Steam saw mills, for cutting plank, curved, and bevelled timber, have been erected in Toulon, Brest, and Cherbourg, and are nearly finished at L'Orient and Rochefort, on the most extensive scale, showing again that the French naval authorities have come to the conclusion that man-of-war ships have to be built in future as before, of wood in preference to iron. The whole dockyard organization in France is of the most perfect description, and allows the Government to carry out its plans with the utmost rapidity. Thus arrangements have lately been made at Toulon and Cherbourg enabling them to put provisions and stores for an army of 60,000 men on board of a fleet in less than half a day's time, and the purport of this can be easily guessed. The plans for new vessels are not made exclusively at the Ministry of Marine, as formerly, but a programme of the works to be undertaken is communicated to all the dockyards—and all the naval constructors, of whom there are 122 in the service, are allowed to submit their plans to a commission, and the plan offering the most advantages, though perhaps coming from the lowest in rank, is adopted. To this excellent system, worthy of a free country, the present high standard of French naval construction is indebted.

WHAT THE UNITED STATES NAVY OUGHT TO BE.

In comparison with the power of the navies of France or England, I must confess ours is not worthy the name of a navy. In conclusion, I may be allowed to say, in order that we may be respected by all the European naval powers, we ought to commence without delay the construction of at least 12 iron-cased frigates of from 36 to 52 guns, each of not more than 25 feet mean draught of water. These will form the nucleus of our real fighting ships at sea. We ought further to have an equal number of corvettes of high speed, and of about 14 to 16 guns each, and about twenty of 30 to 50 gun frigates, and an equal number of screw steam sloops of war of about twenty guns each, both latter classes of the highest speed obtainable, so as to allow them to evade their iron-cased opponents. The latter vessels will always prove of excellent use in case of a foreign war in harassing the enemy's commerce. All these ships ought to be built of timber, and in the most substantial manner. Not until this increase has been accomplished shall we command respect as a nation.

Iron ships ought not to be adopted in our sea-going fleet, for the following reasons: 1. The fouling of their bottoms (against which no remedy has been found yet), and consequent loss of speed. 2. The weakness of their bottoms, and consequent liability of soon breaking up whenever they touch. 3. The impossibility to give them a good ventilation, all the artifical means having failed to produce a good ventilation, on account of the many water-tight bulkheads necessarily used in their construction. 4. Their great unhealthiness, as proved already by the few cruises made by the "Warrior" and "Defence."

Yours truly,
Donald McKay.

HOLMAN'S PUMPS AND BAR RUBBER VALVES.

Mr. Holman of Cannon-street, appears to pursue the study of hydraulics to good purpose. He brought out a double-action pump in the year 1854, which has been most extensively used. He also entered a provisional specification in the year 1857 (No. 1679), for improvements in force pumps, from which the following is an extract:—

"The chief object of this invention is to simplify the construction of force pumps by applying thereto an elastic compound valve, in place of the ordinary arrangements of clack and other valves. This valve is formed of a cup of vulcanized rubber, which is applied to the lower end of the pump cylinder between it and the inlet pipe, so that its bottom covers the inner end of the pipe, while the lip or upper part of the cup surrounds and lays closely against the cylinder which is pierced at that part with holes for the discharge of water from the cylinder."

It appears that Mr. Morris, the well known engineer of the Kent Water Works, patented the same valve in the year 1861, four years afterwards. The following extract is from the *Engineer* of Oct., 1862:—"The pump valve, patented by Mr. Morris, of the Kent Water Works (No. 323), 1861, has been provisionally specified by Mr. S. Holman in 1857 (No. 1679)."

The annexed illustration furnishes a new arrangement of the pump, and a new form of valve, both of which contribute to the production of a concentrated mechanical arrangement and a compact and simple pump. We have seen the model which Mr. Holman has at his office, 18, Cannon-street, which is provided with a glass barrel, through which the peculiar action of the valves may be observed; and there are one or two remarkable features in the operation of the valves which we think worthy of notice. The model simply represents an ordinary house-pump fitted with the bar rubber valve, in lieu of the ordinary clacks, the valves being placed in what may be termed bottomless grooves and seatings against the two sides, as shown in Fig. I of the annexed illustrations. The seating of the lower (or suction) valve is stationary, and that of the bucket moves up and down the barrel in the usual way. The inventor here realises the practical development of his theory, that "the fluid having a free passage on all sides of the valve, a comparatively free and unobstructed egress will be obtained; this is demonstrated in the following manner:—At the up stroke of the bucket the water passes through the lower valve, and in its distended position the valve moves freely in a circular direction, showing that the round sectional form of the valve maintains its central position in the issuing stream. This peculiar motion is also imparted to the bucket valve notwithstanding its traverse at right angles with the circular plane. The action or opening of the valve is comparatively little, and very quick; unlike the clack or other disc valves, it does not float away with the current to any unnecessary extent, but simply stretches out to allow the fluid to escape equal to the traverse of the piston, and closes instantaneously at the termination of the stroke in either direction. This arrangement will be found very useful for air pumps and blast engines, because the firm and steady seating of the valve secures the duty of the full length of the stroke.

FIG. 1.

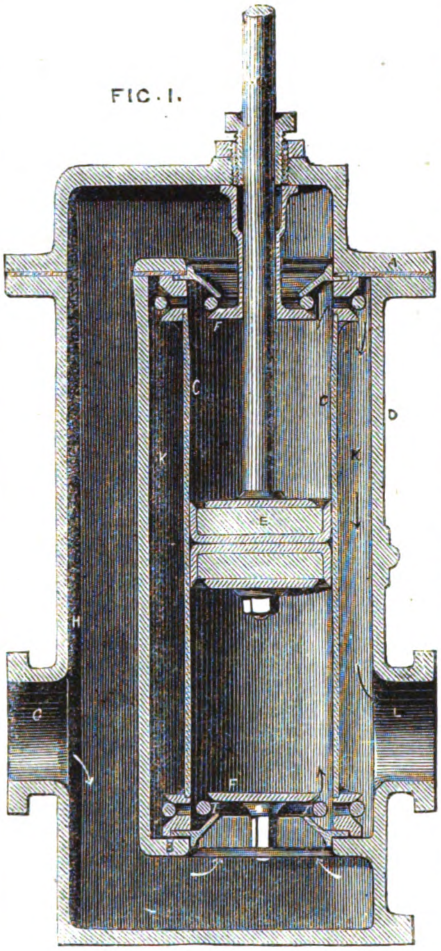


FIG. 2.

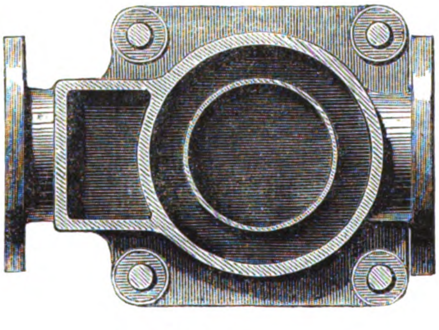


FIG. 3.

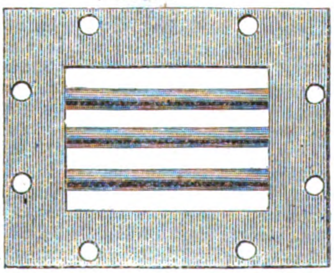
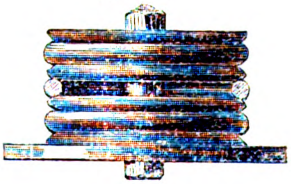


FIG. 4.



The following are extracts from Mr. Holman's specification:—This invention relates, firstly, to a novel arrangement of pump. The pump consists of a barrel or inner cylinder, placed within a cylindrical casing (which may be used as an air vessel) leaving a space all round between the inner andouter cylinders to permit the discharge of the fluid at or beyond each end of the barrel alternately. The piston, in its reciprocating motion to and fro in the barrel, operates upon the suction and delivery valves so as to cause the water or other fluids to flow into and out of the pump whichever way it is moved; it will thus be a double-action pump. The delivery valves are made to encircle the outside of the cylinder or working barrel or seatings at the top and bottom, the upper suction valve or compound valves (as the case may be) to encircle the rod and to be operated upon from the top side of the piston, the lower suction valve or compound valves to be placed on the seatings (which may be either cylindrical or flat), so as to be operated upon from the bottom side of the piston. The cover of the pump is constructed with a chamber or space formed all around the stuffing-box, so that at the descent of the piston the fluid will be admitted to the barrel above the piston through the upper suction valve or valves, and at the same time be forced out from the barrel by the lower side of the piston through the lower delivery valve or valves; and at the ascent of the piston the fluid will be admitted to the barrel below the piston through the lower suction valve or valves, and at the same time be forced out from the barrel by the top side of the piston through the upper delivery valve or valves. The bottom of the pump has also a hollow space or chamber for the water or other fluid to pass freely to the lower suction valve. The fluid may be conducted to the top and bottom of the pump by separate suction pipes, or by a suction pipe common to both, and may be discharged from the pump through one or more outlets in the outer cylinder or case. For many purposes no other support will be necessary for the working barrel than that of holding it between the pump cover and bottom, the cover and bottom of the pump being secured by bolts or any other convenient mode of fastening to the case or outer cylinder, are at the same operation made to press on each end of the working barrel, which may have flexible rings between to ensure soundness of joint, thus leaving the outside of the working barrel entirely free.

In this pump I leave myself free to use the flexible cylindrical valves, according to my specification, dated 16th June, 1857, No. 1679, or the disc valves, as frequently used in pumps, or new valves and seats made according to the following description, in the second and third parts of this invention:—

The invention consists, secondly, of new forms of pump valves and seats, viz., I purpose to make flexible valves of india-rubber or other suitable material, in such forms and proportions as that each valve shall close an opening or space by a lateral or inclined bearing against the two sides forming the seating for the valve. I purpose to make the valves generally of round pieces of india-rubber or other flexible material, and to form them in roundings, such as would be represented by making a round bar of iron into a hoop and welding it into an endless ring. The endless ring of flexible material thus formed may be either put or stretched on to a cylindrical seat, to be expanded therefrom by the action or pressure of the fluid against the inner surface, and to close thereupon when the pressure is removed from the inner surface; or they may be placed upon the surface as upon the area of a bucket; or they may be made in longitudinal pieces, either singly or several pieces connected at the ends or other parts, and placed at distances corresponding with spaces on the area of the seat. This invention consists, thirdly, of the application of a double ring valve made in U form, similar to the double cup leather used in hydraulic presses; the inner ring to form the suction valve and the outer ring to form the delivery valve, by operating upon seats adapted for them, or the outer ring may be made to form the suction valve, and the inner ring the delivery valve, according to the arrangement of the communicating passages.

In the accompanying engravings, fig. 1 represents the pump in longitudinal sectional elevation; fig. 2 is a section of the same. A, A, is the cover of the pump; B, B, the bottom; C is the pump barrel; D, the pump case (which can be used as an air vessel); E, the piston; F, F, the seats of the two suction valves; G, the inlet; H, the passage, communicating to the upper and lower suction valves; I, I, I, I, are the four flexible valves; K, the space or passage around the barrel, into which the fluid is forced at the ascent and descent of the piston through the upper and lower delivery valves; L is the outlet; M represents a hand lever; N, a spring stanchion; the spring in the stanchion obviates the necessity of a third pin, and reduces the number of wearing parts; but the pump may be worked by any ordinary method of actuating reciprocating rods.

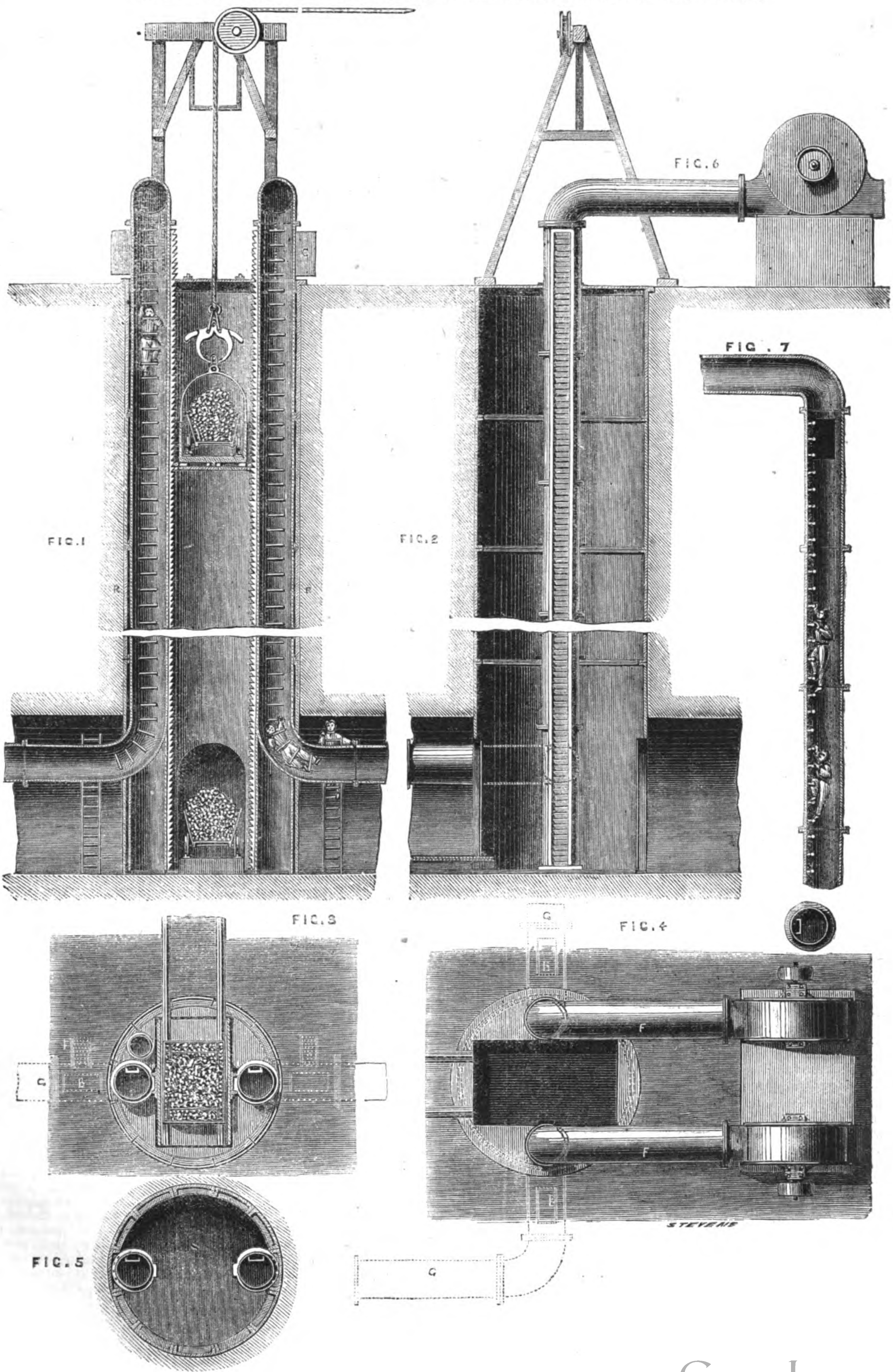
Fig. 3 represents a compound longitudinal valve in plan; Fig. 4 represents three conical ring valves on a treble space seat, the middle ring or valve being in section.

The action of the pump is as follows: — When the piston performs the upward stroke, the lower suction valve and the upper delivery valve will be expanded from their seats simultaneously, the fluid will then enter the barrel below the piston, and be discharged from the barrel above the piston at the termination of the upward stroke; these two valves (being elastic) will close quickly on their seats, and at the downward stroke of the piston the upper suction valve and lower delivery valve will be actuated in a precisely similar manner; the quick repetition of this action will effect a copious and continuous discharge at the outlet L.

We learn that Mr. Holman has secured his invention in England, France, and Belgium. And we hope it will have the success it appears likely to achieve."

Mr. J. H. Foley, the sculptor, has been elected a member of the Belgian Academy of Fine Arts.

RAE'S PLAN FOR THE PREVENTION OF ACCIDENTS IN MINES.—SEE PAGE 68.



THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS, MANCHESTER.

A SPECIAL meeting of the Executive Committee of this association was held at the offices, 41, Corporation-street, Manchester, on Tuesday, January 20th, 1863, Hugh Mason, Esq., Vice-President, in the chair, in order to take into consideration a retrospect of the transactions of the association during the past year of 1862; when Mr. L. E. Fletcher, chief engineer, presented his annual report relating to matters of an engineering character, from which the following facts are extracted:—

It appears that all the boilers under the care of the association have received their full complement of examinations during the past year, including an annual visit of inspection from the chief engineer; while the report goes on to say, "820 of these boilers have been examined 'thoroughly,' that is when empty and cold, when the inspector not only gets inside them, but also goes up the flues, so as to ascertain the condition of the plates and seams of rivets throughout. The number of these 'thorough' examinations this year is higher than it has been in any preceding one since the commencement of the association, and is nearly double that of last year." In consequence of this increased number of "thorough" examinations, it was stated, that a larger number of defects than usual had been revealed, and which would otherwise have been unknown; an additional illustration of the importance of these "thorough" examinations. "The defects discovered in boilers are mainly of two classes, one relating to their construction and the other to their condition. Under the first head, namely, that of construction, 196 recommendations had been made, which are as follows:—

"In 163 boilers the internal flue tubes have been recommended to be strengthened by hooping.

"In 18 boilers the shells have been recommended to be strengthened at the steam domes by stays of angle iron, &c.

"In 9 boilers the shells have been recommended to be strengthened at the ends.

"In 16 boilers the load on the safety valves have been recommended to be reduced."

Under the second head, namely, that of condition, 85 defects had been discovered, all of which were considered dangerous; they are as follows:—"Fracture of plates and angle irons, 13; Blistered plates, 1; Furnaces out of shape, 12; Corrosion, 37; Defective safety valves, 5; Defective water gauges, 9; Defective blow-out apparatus, 7;" others not actually dangerous, but still unsatisfactory, were then given, which need not here be repeated. The report then went into a detailed consideration of the defects discovered under each of the above heads; some of the remarks on corrosion may be given.

"Corrosion is found to be going on in all boilers more or less, and it will be seen that the greatest number of dangerous defects in the preceding table are to be found under this head.

"In one case a boiler set upon a mid-feather wall 15 in. thick, had a channel eaten right along it about 8 in. wide, which ran down the centre of the seating, while the plates at the edges of the brickwork appeared quite sound, and the danger consequently passed for some time unsuspected. In a second instance, with a mid-feather 2 ft. wide, the plate was found to be eaten almost through from nearly one end of the boiler to the other; while in a third, where lime had been allowed to come in contact with the boiler at the mid-feather, the plate was completely pulverized and could be carried away in handfuls. In a fourth case, a vertical tubular boiler had been placed close to a wall, one being in actual contact. Damp in the brickwork set up corrosive action in the plate, which being concealed by the position, went on undetected until the metal was completely eaten through, and a piece blown out by the pressure of the steam. The original plating of the boiler was thick, the pressure low, and the corrosive action local, only affecting a surface of about 12 in. square, so that the rent did not extend.

"Examples of corrosion might be multiplied indefinitely; enough, however, has been said to show the importance of having all parts of the boiler accessible to examination, the flues sufficiently capacious, and the seatings as narrow as possible, and also of having the brickwork removed occasionally, at all events in places, so as to ascertain the condition of the plates, since to conclude that the parts concealed are in the same condition as those in view has been found in practice to be fallacious."

Under the head of Explosions it was stated:—"It is to be regretted that no means exist of ascertaining the whole number of steam boiler explosions that occur throughout the United Kingdom, and there can be no doubt that many are never recorded at all. There are known, however, to have occurred during the last year no less than 31 explosions, from which at least 87 persons have been killed, and 88 injured. Of the number of lives lost by some of the above, no account could be obtained; while from one of them, as many as 29 persons were killed and 12 injured; from a second, 12 were killed and 24 injured; and from a third, 6 were killed and 8 injured.

"The following list gives the description of boiler to which the explosions have occurred, with the number of each class, as well as of the persons killed and injured:—4 Haystack Boilers—12 persons killed and 5 others injured; 6 Plain Cylindrical Egg-ended Boilers—6 persons killed and 6 others injured; 3 Iron Works Boilers—47 persons killed and 44 others injured; 3 Plain Single-flued Cornish Boilers—2 persons killed and 2 others injured; 2 Plain Double-flued Lancashire Boilers—4 persons killed; 3 Locomotive Boilers—4 persons killed and 2 others injured; 1 Agricultural Boiler of Tubular Portable Construction—4 persons killed and 4 others injured; 1 Kitchen-range Boiler—1 person killed. Also 8 other boilers, of the construction of which no reliable information could be obtained, but from the explosion of which 27 persons were killed and 22 others injured."

An analysis of the causes of explosion then followed, the summary of which only can be given:—"Of 31 explosions which have happened during the year 1862, 11 occurred to externally fired boilers, from failure of the plates exposed to the action of the fire; 3 resulted from internal corrosion, and 3 from external; in addition to which, 4 were due to improper original construction, one to shortness of water, and another to accumulated pressure through want of a safety valve; while 7 occurred at a distance which precluded a personal investigation of their causes, at the same time that no reliable information could be obtained with regard to them."

It was also stated that since the foundation of the association 8 years ago, "It has been found, upon limited inquiry only, that throughout the United Kingdom no less than 213 explosions have occurred, which have been attended with the loss of 472 lives, in addition to serious injury to 512 persons, and considerable damage to property."

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

AT a late meeting of the Manchester Philosophical Society (E. W. Binney, F.R.S., F.G.S., president, in the chair), Dr. Joule read the following letter addressed to himself:—

"Varagnes, near Annonay, Ardèche, France,
"November 25, 1862.

"DEAR SIR,—I am much obliged to you for the disinterestedness you have maintained in reference to the discovery of the great principle that my uncle, the celebrated Montgolfier, revealed to me some sixty years ago. Since that time I have passed my whole life in studying this question.

"Much merit is due to you, Sir, for your defence of another's rights, especially after the compositions which you have published, and are, without doubt, the best explanations yet written of the great principle so continually occupying you, myself, M. Grove, M. Mayer, and many others. Among the latter there are many who endeavour to persuade the public (every one in his interest) that the world owes the great advancement of the *dynamical theory of heat* solely to their works; but the public do not like being led in this kind of logic, and look with indifference upon the pretended authors of these discoveries, at the same time raising the merit of those, like yourself, who take a pleasure in rendering justice to those who wait patiently until just and impartial men judge them by their works and not by their words.

"For more than sixty years I have studied the question of identity of caloric and movement, and yet have perceived no advancement of this subject; nothing that either has been said or written has helped me towards the conviction I have arrived at. Indeed, almost all the experiments since then have proved this a fact (which formerly no one endeavoured to contest), viz., that immediately movement disappears, heat is produced, reciprocally. We cannot, however, praise too much your studies, and those of the physicists who have followed you, having witnessed the details of this great principle and calculated the different circumstances with the utmost accuracy. All the attempts in giving a plausible explanation of the phenomenon in question have generally conveyed this opinion, that the molecules of bodies, as well as those of ordinary matter, are liable to Newton's attraction, and, consequently, must be separated from each other by spaces infinitely larger than they occupied before; then, they must keep their distances from each other by virtue of laws, if not identical, at least analogous with those which govern the celestial bodies and maintain in fixed boundaries the distances between the planets and the stars, which determine their course.

"Such were the ideas I had, when addressing a letter on this subject to the celebrated and most learned Sir John Herschel, when president of the Royal Astronomical Society, the most distinguished man of our time for his philosophical genius and his wise and judicious manner of treating sciences, well known to me through the connection I have had with him.

"We are indebted, Sir, there is not a doubt, to the solid and enlightened spirit that characterises the English learned, for the development made in your country on this interesting question, which occupies the most learned men in the world. I have endeavoured to engage, by numerous papers, the attention of the members of the French Academy of Sciences, my colleagues, upon this important subject, but without avail. But I take the liberty of asking you to communicate this letter to the members of the institution of which you are a member, and, should I obtain its publication, I hope my studies will be known by all your learned colleagues, and contribute to enlighten the opinion of those who pursue this branch of science.

"The letter I addressed, on the 2nd of April, 1824, to Sir John Herschel, has been translated into English, and was sent to Sir David Brewster, who inserted it, on the 24th of April, 1824, in the 20th number of the *Edinburgh Review* (page 280), in which I expressed an opinion that the cohesion of the bodies constituted on the surface of the earth may be liable to attraction, which will tend to join in their centre of gravity the composed molecules. I also explained the great difficulty I had in attaining this result. Indeed, if the particles of invisible and invaluable bodies could maintain their distances by the same laws as the celestial bodies, the former would necessarily be perceived, for they would be obliged to collect themselves in a symmetrical and regular manner about their centres of gravity, and make their movements apparent to our senses. I have understood since that a law exists, unknown to me, determining the organized parts of bodies to keep a distance, and to preserve the permanent forms they exhibit. Therefore I studied incessantly to solve a question of so great an interest, and in 1836, after twelve years passed in study and meditation, I was fortunate enough to succeed. Indeed, an attentive examination of the manner of action exercised reciprocally by the particles and generally by all the bodies brought this result: If systems of two or several molecules, being comparatively in repose, traverse other systems comparatively in movement, the former separate the latter from another, losing a part of their own movement. Consequently, the question of cohesion was for me implicitly resolved; and, after eleven year's further reflection, I began to publish (in 1848) the series of papers I have read in the institute, and in which I proved, under the name of Distension, the new result of Newton's attraction applied by myself.

"Then, making myself better acquainted with this law, I published, in 1855, a large volume upon cohesion, and in 1859 another upon the origin and propagation of force, in which I have perfectly explained these principles, trusting to my own proofs and experience. Moreover, I published in 1861, in the form of a letter addressed to M. Tramblay, director of the *Cosmos*, a third paper in reference to the same subject. But yourself, Sir, a physicist of the greatest reputation, and who have taken quite a different direction in science not attempted by any other, must know very well how difficult it is, even for those who sincerely wish the triumph of truth to leave ideas and old practices in which they have grown up. To attain this result, we must have confidence in ourselves. New ideas, however clear and judicious they may be, are never adopted immediately, but by degrees, so that those who are occupied with the same question, already explained by their predecessors, fancy themselves the discoverers and authors. After several generations, however, when the tomb is closed above all, historians and commentators will re-establish the truth of the facts, and render them due justice.

"Mr. Faraday, your fellow-countryman, gave me that great satisfaction, and his powerful testimony has paid me more than I ever could hope, for the oblivion with which several of my contemporaries wished to cover me, who endeavoured to uphold one another without attaining anything but ridicule, the public always being just and free from prejudice, even if the question is above their intelligence.

"Let us console ourselves, Sir, should our efforts rest in obscurity and not be valued as we suppose just; let us be assured that those who will follow us will know how to sift the true from the false, that they will adopt the one and reject the other; and that, if the opinions we have exhibited are just and exact, they will be duly valued one day. But we shall not complain for the present to see our reputation injured by errors we have incurred, perhaps at the first moment, for these errors will have the definite result of classing us according to merit in the history of science. I am, &c.,

SEGUIN, Aine.

(M. Seguin also claims to have invented the tubular boiler).

In connection with a conversation on the solutions of different salts with which almost all the waters in England are contaminated, and the practical evils resulting from these impurities to steam-boilers, Mr. Spence stated that various means had been adopted, with only partial success, for preventing incrustation on boilers caused by these impurities. For some years he had adopted a simple plan, which is perfectly successful, both at Goole, where the Aire and Calder Canal has a considerable amount of lime salts, and also at his Newton works, where the water from the Rochdale Canal is not only impregnated with lime salts, but apparently also with sulphate or chloride of iron. The plan is as follows:—On the suction part of the water-pipe by which the boiler is supplied, that is, between the force-pump and the canal, a small vessel is placed, capable of containing about two gallons, of water; a pipe of half an inch diameter, with a stop cock, communicates from the water-pipe with this vessel; every day the boiler man puts into this vessel 1 lb. or 1½ lb., as found sufficient, of soda ash, and dissolves it in water in the vessel, and then, when pumping into the boiler, turns the small cock, and in three or four minutes all the solution is taken up and passed through the force-pump into the boiler, and this is daily repeated; the consequence is, that not the slightest crust forms on the boilers, and no chipping is ever required, the salts being all decomposed, and the earthy and metallic bases thrown down as mud, which may be blown off or cleaned out periodically, if the boiler is a flued one. These two boilers are cleaned monthly, and a broom and shovel are the only tools required. The plan is easily adopted, perfectly efficient, and very generally applicable.

Dr. Joule drew attention to the great sacrifice of life by steam-boiler explosions. He believed that, in nearly every instance, rupture took place simply because the iron, by wear or otherwise, had become unable to withstand the ordinary working pressure. Various hypotheses set up to account for explosions were worse than useless, because they diverted attention from the real source of danger. He believed that one of these hypotheses—that which attributed explosions to the introduction of water into a boiler, the plates of which are heated in consequence of deficiency of water, was quite inadequate to account for the facts; although weak boilers might be exploded at the moment of starting the engine, in consequence of the swelling of the water through renewed ebullition throwing hot water over the heated plates. The absolute necessity of employing the hydraulic test periodically had been pointed out so frequently that he considered that the neglect of it was highly criminal.

AT the ordinary meeting of this Society, on the 13th inst., Dr. JOULE described a peculiar kind of mirage which he had witnessed from the northern extremity of Douglas Bay, Isle of Man, and at an elevation of twenty feet above the surface of the water. At about nine a.m. a number of chimneys in the town were fired, and the products of combustion were driven out to sea by a very gentle breeze. Presently the wind changed, and drove the smoke at right angles to its former track. The steamer for Liverpool had, in the mean time, attained a distance of about three miles, and, although somewhat obscured, was distinctly visible through the smoke. Noticing something extraordinary in her appearance, he viewed her through a telescope, and then observed that nearly the whole of the hull was obscured by the horizon, the uppermost part of the paddle-boxes, the bowsprit, and tafferel being alone visible, whilst at the same time the masts and funnel appeared considerably elongated. Quarter of an hour afterwards, when the smoke had cleared away, and the steamer was about seven miles distant, the hull was seen as usual, quite unobscured by the horizon. Dr. Joule attributed the phenomenon to a stratum of highly refractive gases, lying about 20 ft. above the level of the sea and gradually diluted and diminished in extent on its upper and lower sides, so as to produce the effect of a convex lens.

Dr. ANGUS SMITH said—I saw once a very remarkable instance of the diversion of the rays of light from the straight line. Although fogs are common on our hills, I have met no instance of similar exaggeration of effect among us. I went with some friends up Skiddaw, and near the top entered a cloud which prevented us from seeing many yards before us, although it was not extremely dark. When moving over those loose stones which form a highway to the summit for a considerable distance, we observed a building which appeared to us about 14 ft. high. The side towards us seemed to be a wall nearly square, and we took it for granted that the top of the hill was attained and that the foremost of the party would be found there; but as we approached the building sank; and in the course of a few steps it went downwards until we found that there were only three layers of stones not very thick, and the whole under two feet high. The disappearance must have occurred within the space of twenty feet; my present impression is that it was less. Further on we attained the man at the summit, and the cloud became denser; we could not see many feet, and I did not think it safe to move from the spot for some time, not knowing the locality. Sitting there I saw four perpendicular lines on the cloud; I looked up and found that they terminated in the body of an animal which was moving slowly towards us. The distance could not be measured, except by the number of steps taken by the animal, and from these I concluded that when first seen it was from twelve to twenty feet from us; I looked on twelve as being most probable. I do not exaggerate when I say that the height was in appearance 30 ft. Wondering what to be the end of this strange vision, I called the attention of all, but the animal diminished in size so rapidly that only one or two, who instantly attended to my call, could perceive the monstrousness of the exaggeration of form now presented by a moderately-sized pointer. On coming up to the more advanced portion of our party, they were enlarged and distorted, as we often hear described; but such effects are comparatively common, and they are not to be compared with the two instances mentioned. The first was seen with my face towards the sun nearly. It was about midday. The second phenomenon was seen 20 minutes later, when looking nearly north.

Although I have lived much in sight of Morven, where one might expect to see the "spirit of the mist on the hills," I had not seen anything similar before, nor have I gained from the shepherds that such things are common. Perhaps if they were common, Ossian's ghosts would be less imposing.

MICROSCOPICAL SECTION.

15th December, 1862. Mr. J. G. LYNDE, F.G.S., M. Inst. C.E., in the chair.

The CHAIRMAN stated that he was led to pursue Dr. Roberts's suggestions on the use of magenta dye in examining tissues. From experiments made since the last meeting of the section, he finds that the dye has no power to colour living tissue, whether animal or vegetable, but that as soon as life is extinct the action of the dye commences. He is continuing the experiments, which are of a most interesting character, and he hopes to lay the result before the next meeting of the section.

Mr. LEIGH considered it probable that so long as vital action continued, ordinary endosmosis could not take place.

Mr. MOSLEY said that Mr. Hepworth had frequently tried magneta for injections, and the results were not satisfactory, as the colouring matter diffuses itself through the whole of the tissues, giving an appearance of dyed flesh rather than that of injected preparations. This appears to confirm the preceding observations, and to account for the accumulation of colour where the integument is thickest, by means of which Dr. Roberts discovered the spot on the red blood discs, as announced at the previous meeting.

Mr. LEIGH drew the attention of the section to the adulteration of size as a cause of mildew in cotton goods.

Mr. WATSON named the investigations made by Mr. Thompson about twenty-five years ago, as to the cause of mildew in madder purple-printed cottons shipped to hot climates. It was attributed to the starch employed in finishing the goods, which, acted upon by moisture, heat, and pressure, had given rise to an organic acid which discharged the colour.

Mr. HURST described his experience of mildew on printed cottons and upon dyed fustians, at Gibraltar and Calcutta. In most cases it appeared in spots and round patches, which affected the colours. On the fustians, he had no doubt it was caused by the growth of a fungus, as the surface of the spots was sensibly raised.

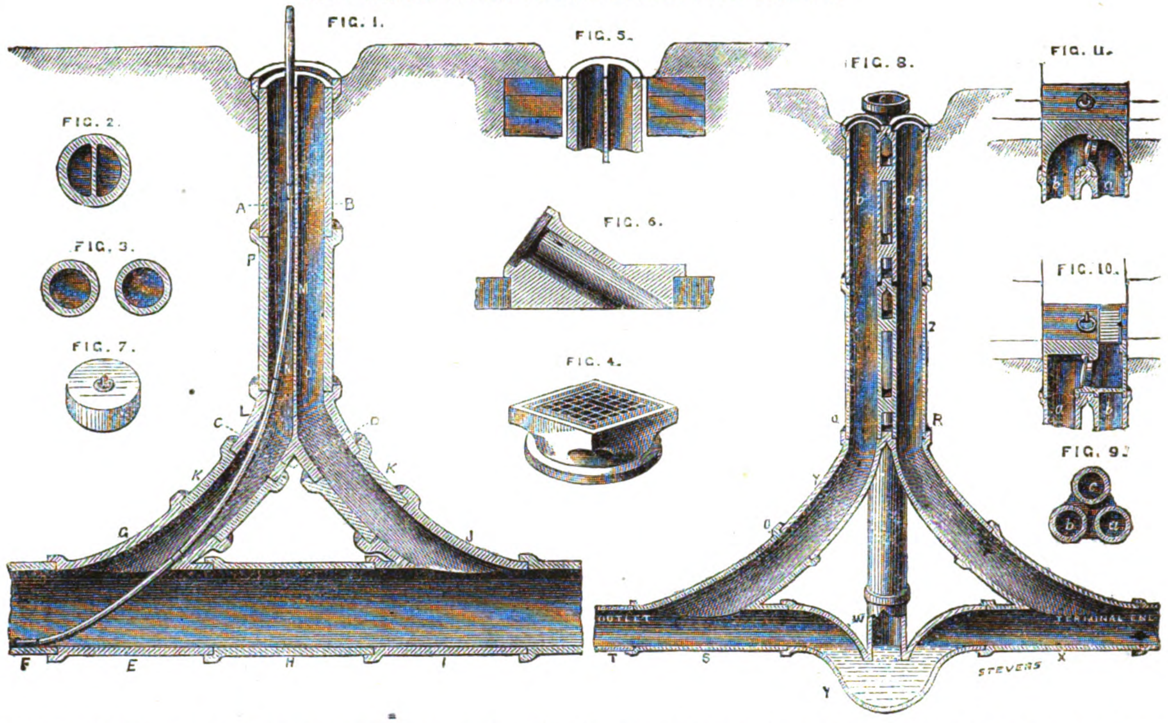
Mr. MOSLEY considered there might be several kinds of mildew; that upon the fustians might be attributed to the size with which those goods were generally furnished, and known by the characteristic smell. Mr. Mosley also exhibited a pattern of grey calico, which had become discoloured and quite rotten in irregular patches, from mildew; it had lain for some time in a damp place, under pressure; there was this peculiarity about it, that the coloured patches whilst damp were quite tender, but on exposure to the air and drying, the cloth had recovered its strength.

Mr. HEYS remarked that twenty years ago he was engaged in the manufacture of fine muslins; it was usual to soak the weft in soap suds to facilitate the weaving: and it was found the cloth was most liable to mildew during hot, close, summer weather, and the greater the quantity of goods heaped togther the more rapidly would mildew set in. The flour from which the size was made was always the best that could be purchased.

Mr. HEYS exhibited mounted specimens of the fibres of the Zostera Marina, and stated that, as the fibre is considerably finer than the finest Sea Island cotton, it might probably be of use in the manufacture of fine muslins for ladies' dresses, if possible to obtain a supply, and separate the fibre from the plant by machinery. Mr. Heys also exhibited mounted specimens of Queensland cotton, lately sold at five shillings per pound; the fibre is very regular in size and much more cylindrical than other cottons; also several specimens from ripe and unripe pods; and Mr. Heys expressed the opinion that great advantage would arise from a regular and careful examination of cotton fibre taken fresh from the plant through every stage of growth.

YELLOW SPOTS ON LEATHER.—Yellow spots on leather frequently occur, and these detract from its value. A correspondent of the *Shoe and Leather Reporter* says they are caused by decomposition in the hide, probably in the sweating process. The remedy, he says, is "more care in the manipulation or working of the hides. With good, cold spring water for soaking, and with a sweat-pit kept at the right temperature, with ice or otherwise, and a cool, sweet liquor for the first stages of handling, there is but little danger of being troubled with yellow spots on leather."

NEW ARRANGEMENTS FOR INSPECTING DRAINS.



NEW ARRANGEMENTS FOR INSPECTING DRAINS.

MR. J. LOVEGROVE, surveyor, of Dalston Rise, has recently obtained a patent for an arrangement of appliances for inspecting small sewers and drains, which he describes as follows:—For the purposes of ventilation, inspection, or flushing shafts at intervals over small drains and sewers, they are constructed from the top of the sewer to the surface of the ground, partly vertical and partly curved, and also in two divisions (for a double shaft), so as to admit of the passing of a bamboo cane (screwed together in short lengths) down one division of the shaft turning into and along the sewer, towards the outlet for any distance, and thus to effect the removal of any obstruction that may have formed between the shaft and the distance reached. Also down the second division of the shaft, turning into and along the drain towards its terminal end for any distance, and thus remove any obstruction that may have formed in this portion of the sewer. The shaft is covered with a marked box adapted, either for carriage or foot roadways, that can easily be opened or lifted off without breaking the ground.

In the construction of ventilating and inspection shafts over house drain traps, they are constructed partly vertical and partly curved, and also in three divisions, so as to admit of the passing of a bamboo cane down one division of the shaft towards the outlet of the drain, or down the second division towards the terminal end of the drain, and down the third division (forming triple shaft) into the syphon dip trap, and thus in each of the places reached to remove any obstruction that may have formed. This shaft is covered with one of two marked box covers, dependant on the mode adopted for the ventilation of the drain, *i.e.*, if the drain is ventilated above the roof, or from its terminal end, then the shaft is covered with a box cover containing an air supply valve, to admit air into the drain down one of the vertical shafts on the inlet side of the drain trap, to pass all through the drain to the exit at its terminal end; and if the drain be ventilated into the sewer, then the shaft will be covered with a marked box cover to contain an air exit valve, to admit from the shaft on the inlet side of the dip trap upwards to and through the exit valve, and down the shaft on the outlet side of the dip trap, the foul air contained or generated within the drain. The dip trap and box valve together sealing the foul air from the sewer. The valve is opened by the pressure of the contained air, caused by a barometic difference of temperature between the air contained in the two shafts, or by the sudden influx of water.

The annexed engravings illustrate the invention more fully.

Fig. 1 is a vertical section of a double shaft for a small sewer; Figs. 2 and 3 are cross sections through the lines A B and C D.

A junction pipe E is inserted into the sewer pipe F with its mouth G curving upwards from the top of the sewer, and downwards in the direction of the outlet, then, next adjoining to and in extension of, this junction pipe, is placed an ordinary pipe H; and then, in further extension, a pipe with a reverse curved junction I, the junction J curving from the top of the sewer, also upward (but downwards), in the direction of the terminal end of the sewer, and the upper part converging towards the first named junction G. A bend pipe K, of a fixed minimum radius, with socket flange at the upper end, and spiggotted at the lower end, is inserted, one in each junction mouth, still more converging towards each other. A breeching and double junction piece L L is then fixed, having two spigot ends downwards and one socketted end upwards, divided by a diaphragm M, and so made that the two spigot ends shall fit into the socketted bends. The top of this breeching piece terminates the curved portions of the shafts, and the vertical portion P commences, which is continued to the surface. This is formed in short lengths of pipe, in iron or stoneware, having a diaphragm M throughout its length, thus dividing the shaft into two sections, N O. The diaphragm of the vertical shaft fits over the diaphragm of the breeching piece, thus forming a separate communication with each curve as it diverges from the bottom of the vetrical shaft towards the outfall, and also towards the terminal end of the sewer.

Fig. 4 is a cover in iron for carriage-ways to indicate the position of the shaft; Fig. 5 shows the top of the shaft with brickwork bed for carriage-ways to receive iron box; Fig. 6 is a longitudinal section of a junction block, used in lieu of the junction pipe J and G in the case of brick sewers. A plain block is then inserted in the arch of the sewer between the two junction blocks, in lieu of the pipe H.

In searching for or removing obstructions, the box is opened and the cane passed down one side of the diaphragm of the perpendicular shaft; the breeching piece gives direction to the cane, which then passes the curve into and along the sewer towards the outfall or terminal end, as may be desired, for any length.

Fig. 8 is a vertical section of a triple shaft for house drains. Fig. 9 is a cross section through the line Q R. Fig. 10 is a marked box cover, containing an air supply valve, fixed there for a ready examination; Fig. 11 is a marked box, containing an air exit valve, also placed here to admit of ready examination.

In the construction of the triple shaft over house drains a curved junction pipe S is inserted into the drain pipe T, with its curved junction mouth U curving upwards from the top of the pipe with a socket flange; then, next adjoining to and in extension of this junction pipe is fixed a syphon dip trap V, with a perpendicular junction mouth, with socket flange W brought up from the centre of the dip, and in further extension of this syphon dip a curved junction pipe X, curving from the top of the pipe upwards, but in the direction of the outfall, and convergent to the before-described junction mouth U. A bend pipe, Y, of a minimum curve, is then fixed with its spigot end, one in each of the three junction mouths converging so as to bring the three bends at the top or socketted ends together, or contiguous to each other. Three vertical pipe shafts Z, united so as to form a triple shaft with spigot and socketted ends, are fitted into the sockets of three bend pipes just before described. These triple shafts are then continued in short lengths to the surface, where it is covered with one or other of two box covers, dependant on the arrangement of the ventilation of the drain, *i.e.*, either a box cover, Fig. 10, with an air supply valve to supply air to the drain through and down one of the three shafts *a*, and through the drain to its terminal end, and thence through a pipe continued above the roof; or a box cover, Fig. 11, to contain an air exit valve to admit from the shaft *a* on one side of the valve upwards, and pass through the shaft *b* on the other side of the valve downwards, and thence into the sewer, the foul air contained or generated into the drain. The dip trap V and box cover together sealing the foul air from the sewer.

TO CORRESPONDENTS.

RECEIVED.—**J. A. D., J. G. F., J. N., Capt. N., P. F. A., J. F., R. T., S. H., H. B., S. T. G., E. J. R., E. B., W. S., J. T., J. W.**

A READER.—Supposing that all your tubes were perfectly homogenous, which is physically impossible, and that all were exactly alike in dimension, which is mathematically impossible, all the tubes would give way at one and the same time. With solid bars, instead of hollow tubes, the result, of course, would be the same.

T. F. (Manchester).—Giffard's injector *does* incrust in the annular water passage round the steam nozzle when hard water is used.

H. J.—We believe that Mr. William Fairbairn first introduced the side-lever arrangement of engines.

Correspondence.

[We do not hold ourselves responsible for the opinions of our Correspondents.]

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GUNS AND PROJECTILES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Under the above heading, in your valuable journal of the 23rd, I notice a letter by "Cosmopolitan," and also a description and an engraving of a flat-fronted shell for penetrating iron plates, which has been patented by Mr. Whitworth. By your kind permission, I would like to make a few remarks on these subjects.

I observe, both in the letter alluded to above, and in your article on the 9th instant, the hexagonal groove system is ascribed to Mr. Whitworth, and the oval system to Mr. Lancaster. Now, Messrs. Wilkinson, of Pall-mall, have in their possession, or had a year or two ago, an old Lapland rifle, *hexagonally* bored, exactly as used by Mr. Whitworth.

The oval bore of Mr. Lancaster will be found described in a work called "Seloppetaria," published in 1805, by Colonel Beaufoy. The narrow linear groove, or "saw-tooth" rifling, as it may almost be termed, as used by Sir W. Armstrong, I saw more than twenty years ago in a Belgian rifle belonging to one of my friends, which had been in his possession for many years. The ribbed bore I saw many years since in a rifled pistol; and I believe there are revolvers yet made so, and with a very little trouble; examples are to be found in existecne of all the known "new" systems of rifling, many of which have been in existence for half a century.

I will now turn to the question of flat-fronted percussion shells, and also flat-fronted shot, for penetrating iron plates, the invention of which is now ascribed to Mr. Whitworth, and also patented by him. In the year 1824, Captain J. Norton completed an elongated rifle shot and shell, and in 1826 we find him using them at Dublin, Woolwich, Addiscombe, and Sandhurst, as well as various other places, *with complete success*; but we find the wise acres then in power opposing their use on many grounds, one of which—and I may say about as good as any of them—was the "liability to wear out by carriage in the soldier's pouch!" In 1832 we find Captain Norton, at Windsor, firing a *flat-fronted steel* punch-formed rifle shot from an air gun, through a Life Guard's cuirass, and exploding powder placed on the other side. This steel, punch-fronted rifle shot was tested at Woolwich in 1828, and Captain Norton stated that it might "also be converted into a shell by drilling a hollow tube into its front," just as shown in Fig. 2 of Whitworth's patent. In the shipbuilding yard of Messrs. Leckie and Beale, at Cork, we find Captain Norton perforating a three-eighth boiler plate, at a distance of forty, and also sixty yards, with his flat-fronted shot. In the concluding part of his patent specification, as quoted in your journal of the 23rd instant, Mr. Whitworth says, "The form which I find to be the best compromise for a penetration shell is that shown," whereby one might be led to believe that the invention of the flat-fronted shot and shell belonged to Mr. Whitworth.

Now, I think it will be pretty evident, from what I have stated, that all Mr. Whitworth can claim is the *mode* of manufacturing shell as described in the specification, and that the form of bore adopted by him is not new; all that is novel being a quick pitch, much quicker than that of any other maker, because we find Captain Norton using and describing *flat-fronted* shells and shot, as the proper form for penetrating iron plates; and he also, many years since, in the MECHANICS' MAGAZINE, though I do not remember the date, states that "if gunpowder is placed within a box made of boiler plates, and the plate is pierced by such a flat-headed steel bolt, *the powder within will be exploded by the heat generated by the blow*.

Now here again is proof of the credit due to the indefatigable Captain Norton, who seems to have possessed the unpardonable fault of being a man before the time; for to him we owe the *expanding* elongated bullet, not the "wood plug" absurdity in use, but a real, sensible, useful shot, the explosive percussion shell, the *flat-fronted shot* for punching holes in iron plates, the credit of which, as well as the use, is tried to be made a monopoly, and various other matters, all of which he has the great merit of having "practically" tested, and not brought forward "on paper."

It is a great disgrace to this country that some substantial acknowledgment has not been long since made to this veteran, who has smelled powder, and been in active service in most parts of the globe, besides having had his share in the great struggle in the Peninsula. One cannot help contrasting, in some bitterness of feeling, the rewards that are heaped on the "featherbed" gentry, who have so laboriously served their country in doing nothing, and the fact that as yet no notice (substantial as it should be) has been taken of his inventions, all of which are now being brought out by others, who are deriving both credit and money from them, whilst the real inventor and first user, is not recognized, is a fact far from creditable to the powers that be; and one cannot help thinking, that if the inventor had laid his plans before another power, we should have had, by the results, additional proof that they "manage these things better in France."

Cannot some gentlemen of influence be got to join in getting up some acknowledgment of Captain Norton's genius? I should be glad to join in trying to do so.

I am, &c.,
C. F. T. Y.

Adelphi, Jan. 26, 1863.

HYDRAULIC PRESSES.

Sir,—In your journal of January 23d, you describe certain improvements in hydraulic presses, recently patented by Messrs. Peel and Simpson, of Manchester, upon which I beg, with your permission, to offer a few remarks.

In the first place, I find that the telescope arrangement of the cylinders and rams claimed in the above patent is already described in the specification of Michael Scott, No. 2713, dated 29th Oct., 1861. Secondly, with reference to the air vessel described, the same does not appear to me to offer the advantages of the ordinary weighted accumulator. The former, as well as the latter, has to be charged with the requisite quantity of water by means of the pumps. In working the press by means of the common accumulator the pressure remains constant, whereas with the air accumulator the pressure will diminish in proportion to the rise of the ram, whilst at the same time the resistance increases. If the ordinary low pressure accumulator be weighted to 1 cwt. per square inch, the ram will rise, till the resistance amounts likewise to 1 cwt. per square inch. It is evident that for producing the same effect by means of the air accumulator, the pressure in the same, at the end of this part of the stroke, must also be 1 cwt. per square inch. Supposing that for the completion of this part of the stroke the air has expanded to double its volume, it is evident that its pressure at the beginning of the stroke must have been equal to 2 cwt. per square inch, and from this it follows that the power required for charging the air vessel is far greater than that necessary for filling the common accumulator.

From the above it is also quite plain that the water cannot possibly return from the cylinder to the air vessel, as stated in the description.

I am, &c.,
January 27, 1863. S. S.

"INTERNATIONAL ASSIMILATION OF PATENT LAW."

Sir,—The excellent article in your issue of Jan. 16, contains a sentence in regard to the state of the American Patent Law which may prove injurious to the interests of European inventors, who have or shall hereafter secure patents in the United States.

Speaking of the patentee, it is stated "he discovers that he is everywhere, except in England and America, obliged to put his patent to work within a time generally varying from a year to two years." Instead of the United States forming a real exception to this general rule, under the Act of 1836, sec. 15, it is sufficient answer in a suit for infringement, to prove that the patentee, if an alien at the time the patent was granted, had failed and neglected for the space of eighteen months from the date of the patent, to put and continue on sale to the public, on reasonable terms, the invention or discovery for which the patent was issued.

Whatever might have been the intention of the framers of the Act of 1861, which equalized the patent fees, they failed, in this respect, to place the alien in the same position as the citizen.

The article contains the following rule of the United States Patent Office:—"The taking out of a patent in a foreign country does not prejudice a patent previously obtained here; nor does it prevent obtaining a patent here subsequently." By the Act of 1836, a person was debarred from obtaining a patent if the invention had been patented in a foreign country more than six months prior to his application in the United States. This clause was repealed by Act of 1839, sec. 6, and on this section the above rule is based. The repeal is made, however, with an important proviso, viz.:—"That the same shall not have been introduced into public and common use in the United States prior to the application for such patent. It will be well for inventors who intend to secure patents in the United States to bear this provision in mind.

I am, &c.,
GEORGE HASELTINE.

12, Southampton Buildings,
January 19, 1863.

Sir,—The articles which have appeared in your Magazine will, as I think, render good service to the cause of inventors. It is, I believe, universally admitted that the patent laws, both of England and of foreign countries, require revision. I have, myself, lately drawn the attention of the legal profession to the subject, feeling that, as a commission has lately been appointed, the present is an adventitious time for suggestions. The subject is a difficult one for legislation, as indeed it has always been since the celebrated "Statute of Monopolies"

An "international assimilation" of patent law is, I fear, too much to expect. The idea is good, and beyond doubt such a thing is desirable, but there are two difficulties in the way, which I venture respectfully to suggest, viz:—

1. The delay which must take place in getting all countries to adopt one system.
2. The corresponding difficulty which would attend the alteration of any system.

Even in England, at present, no system is as yet suggested, even by inventors, so far as I am aware. Patents are based, as we know, upon a sort of contract between the people and the inventor, the Sovereign acting as the representative of the people's interest. I fully agree with you, that it matters not whether an idea be "embodied in a mechanical or chemical combination; or whether it be developed in a product of art; or it be expressed in a literary work; it is an international benefit." But the great question to be settled is this: *Should the novelty be local or universal?* In strictness, no doubt, as I apprehend, the novelty should be universal—for if not so, how is it a "new idea?"—but the English laws are based upon the assumption that the invention is only within their realms. Perhaps in a future letter I may have a little to say as to the patent laws of other countries, but I reserve my observations for the present.

An "idea" is clearly, I think, a man's property. It may be the result either of reflection or investigation. On some occasions it is the result of instantaneous observation, but the idea, nevertheless, I think, involves a "property." But whilst this is so, the novelty and utility of an invention should, as I think, be tested by a scientific tribunal. A large number of inventions are, comparatively speaking, useless, to say the least. This being so, it must not be forgotten that the public have their rights as well as inventors, and it not unfrequently happens that a patent is a very serious restriction upon the rights of the public. It is no easy matter to "balance the scales" equally, so as to give a reasonable protection to inventors on the one hand, and to the public on the other hand. The subject will now, I think, be reviewed in a fair spirit, and it is to be hoped that a less objectionable system of patent laws will be the result.

I am, &c.,
T. CULVERHOUSE.

3, Compton-street, Ballspond,
January 19, 1863.

THE CAUSE OF APPARENTLY *COLD* STEAM.

Sir,—It has been suggested to me, that, for its more extensive reading, I make the following communication to your pages:—

The cause of what is termed *cold blowing* steam is generally considered to be the recovery of i capacity for receiving heat, which then becomes latent, it being supposed that the superheating of steam, or rather the spaces (interstices) surrounding its particles, in some way, prevents the steam itself from receiving its proper accession of heat; but this explanation, the notion of latency as regards *the thing itself*, rapidly losing ground among men of science, will not, I apprehend, long be tolerated as the *received* opinion; on which ground, and also because I am convinced of its falsity, I here present the reader with the following eminently practical explanation:—

The phenomenon may be accounted for by the enormous increase of the steam's expansive force, which is clearly the consequence of its superheating, the abnormal heat furnishing it with a truly prodigious elasticity, which elasticity, causing its particles, when the steam escapes, to be driven asunder with inconceivable rapidity; prevents the sensation of heat from being experienced; each particle, when the hand is placed in the steam, passing over all its parts too rapidly to raise the friction known as heat, from which cause we have the phenomenon of *cold* steam. I must grant that, if the notion of latency be received, the doctrine of steam, upon its being set free, receiving heat, and making it latent (the consequence of which absorption, we may suppose, would be the absence of the sensation), will be considered the probable one; but my explanation is founded upon the *improbability* of any kind of latent substance. I am, &c.,

J. ALEXANDER DAVIES.

January 22, 1863.

STEAM FIRE ENGINES.

SIR,—There is an error in your last, which, as referring to an historical fact, permit me to correct. At page 52, it is stated that "in April, 1860, the London Fire Brigade agreed to hire on trial for twelve months a (steam) fire engine, constructed at the expense of Messrs. Shand and Mason. This steam fire-engine was found so serviceable that it was purchased, and several others were ordered, all of which are now in use by the London Fire Brigade."

The first steam fire-engine, so hired of Messrs. Shand and Mason, and made in conformity with their first patent, described in your pages, came out in July, 1860; its performances were *not* satisfactory, and in May, 1861 it was withdrawn and replaced by one on a different construction, in many respects like that Mr. Braithwaite brought out in 1830. A second, on this principle was supplied to the fire-brigade about the middle of last year, but a third was upon another and different construction, patented by Messrs. Shand and Mason in 1862. In Captain Shaw's report to the Committee of the London Fire Establishment, in December 1861, he stated that "the three land steam fire-engines recently ordered would be finished in about six weeks from that date." Various mishaps, however, prevented their anticipations from being realised, and two of them only have yet been delivered.

I am, &c.,

A CONSTANT READER.

London, January 27, 1862.

IRON WALLS AND THEIR ARMAMENT.

SIR,—During the last session of Parliament I availed myself of your permission to publish opinions on "Iron Walls" in the MECHANICS' MAGAZINE. Since then the subject has intensified in interest, and, has, it is no exaggeration to say, become a great national question. It is one which cannot be evaded or shelved. It will force itself into notice in its various aspects, naval, military, political, manufactural, and financial. Never was there a more stupendous question to be investigated and settled.

The approaching assembly of the council of the nation makes me desirous of again finding space in your columns for the expression of my views on the subject in question.

My opinions may be erroneous. If they are they share the fate of those of great authorities, military, engineering, and scientific, to whom the effects of guns on iron is a new study, of which they all have had to learn their A B C. But, by giving currency to opinions, and stating facts, I may help to provoke discussion, enlighten the public, and direct the attention of members of both houses to points which might otherwise escape notice.

There is, just now, an additional motive for fixing attention on the matters referred to. A number of experiments of an important and interesting character will, in the course of the next few months, take place at Shoeburyness. Of these it is desirable that the reports, if any are allowed to appear in newspapers, should be faithful and impartial, and not one-sided or garbled, such as the reports of target trials in the *Times* have almost invariably been. Hitherto, that journal, with a few exceptions, has had the monopoly of reporting experiments at Shoeburyness and Portsmouth, and in return for the easy access its reporters obtain to official sources, the leading journal pays the tribute of "quasi" official reports in terms calculated to support Government, and mystify or mislead the public.

If, on national grounds, the accounts of Admiralty and Ordnance doings and experiments were to be, or could be, a sealed book, I should be the last to give them publicity; but when it is notorious, on one hand, that foreign Governments, through their agents, who are always on the *qui vive*, are well informed on every move in our dockyards and arsenals; and, on the other hand, foreigners of all nations are allowed to inspect the works in progress in Government and private yards, and to witness all or any of the experiments—it would be affectation to require or maintain secresy. Under these circumstances, it is far better for the public interest that, instead of being dependent on the pretensious and oracular paragraphs of the *Times* for "naval and military intelligence," other sources should be opened. So far as I am able, I will contribute to elicit and give pnblicity to the truth, on the multitudinous questions embraced under the heading to this letter; comprising the manufacture and construction of armour plates, with their supports, fastenings, and backing, and the requirements of iron-cased ships and forts, guns and projectiles. These questions must be treated in a popular and somewhat desultory fashion, as they arise out of events which, from time to time, fix public attention.

IRON FORTIFICATIONS.

It is hardly possible to overrate the importance of iron fortifications, whether applied to ships or land works. They inaugurate a new system of naval and military tactics. The iron-clad man-of-war annihilates timber-built navies. Stone or brick fortifications are powerless where an invulnerable floating battery brings its guns to bear at short range.

Until the world was startled by the terrible and swift destruction hurled upon powerful first-class frigates from the iron sides of the "Merrimac," whilst she herself was proof against the heaviest missiles, it was not remembered that the effect of projectiles on ships or land forts results more from the hardness of the material of which the former are composed, than from the explosive force of the gun from which they are fired. It is iron against wood or masonry. The contest is unequal: iron has the best of it.

But when iron is opposed to iron, the conditions of the conflict are altered. Iron cannon balls, which cannot be resisted bp wood or masonry, will not so easily penetrate iron. I was, I believe, the first to point out the analogy between the penetration of iron plates with iron or steel projectiles, and the ordinary process of punching holes in boiler plates. It is an established law that a plate cannot be perforated by a punch less in diameter than the thickness of the plate. This law is confirmed by recent experiments at Shoeburyness. The Whitworth shot and shell of 7 in. diameter perforated 5½ in. plates, and those of 5½ in. diameter perforated 4½ in. plates, but could not pass through 5½ in. plates. And in the trial of an ordnance target constructed by Capt. Inglis, R.E., a 120-pounder Whitworth steel shot was smashed to atoms against an 8 in. plate.

Iron plates, therefore, of the required thickness and security, fastened to a structure of sufficient solidity, will be impenetrable by iron projectiles. Whatever may be the weight and velocity of the latter, their inferiority in volume and weight to the body opposed to them will, under the punching law, ensure their destruction; the material of both being of equal hardness. The value of hardness for penetrative effect is proved by the process of punching boiler plates. The punch being of steel, is easily forced through the iron plate. An iron punch could not be relied upon. The Whitworth projectiles, being of steel, penetrated iron plates which were impervious to iron shot.

Thickness of armour, which means weight of iron, has its limits for a ship in her carrying capacity. But for land fortifications there is no limit, therefore the application of iron to protect forts is a question of even greater importance than naval armour, because the former may be made completely invulnerable. There is a limit to the size of guns, but there is none to the weight of iron with which forts may be cased. In these two facts there is the germ of a new system of fortification for coast, harbour and river defences. Iron walls afloat must be opposed by iron walls on shore, for a squadron of efficient iron-clads would render the strongest stone batteries untenable.

But, in determining the value of iron for fortification, we are only on the threshold of the question. Iron, from its very nature—its hardness, its weight, and resistence to any agency but that of fire, or a metal harder than itself, is a material which demands skill, science, and costly appliances for its manipulation. The manufacture of armour plates, their size and form, and the mode of supporting and fastening them, are at present imperfectly understood, and require deep thought, profound research, and, above all, intelligent and numerous experiments.

These remarks are a brief *resume* of the points of view in which the question of iron fortifications is proposed to be considered under its different heads.

REED'S COMBUSTIBLE IRON-CLADS.

At the opening of Parliament the paramount question of national importance will be, "Are we to have an iron or a wooden navy?" As a natural seqnence, "wooden bottoms with iron top sides" will be discussed.

For this reason, I am induced to enter fully into the subject of Reed's iron-clads.

Next to invulnerability, the essential quality of an iron-mailed man-of-war is incombustibility. On more than one occasion I contended that the Reed plan did not fulfil either of those conditions. I described the incongruity and inefficiency of his proposed combination of iron and wood. These criticisms were met by denial of facts, and a refusal, on the pretended ground of a patriotic regard for national interests, to give explanations which might have satisfied the public if I was in error.

Some weeks ago an article in the MECHANICS' MAGAZINE, condemning the gun tower principle, exposed the blunder of the *Times* in asserting that broadside ships could not safely carry the heaviest guns. It also pointed out the advantage of placing great guns amidships, and showed that that arrangement was an essential part of Capt. Cole's system.

Simultaneously, the *Engineer*, in a notice of the same question, stamped with the authority of the clever secretary of the Institute of Naval Architects, put the case of a cupola ship armed with ten 12-ton guns, in five shields, the whole weighing 620 tons, and asked, "Who would not greatly prefer to incorporate 500 tons out of the 620 tons, in the *hull of the ship?*"

I took a different view, for whilst I joined in condemning the revolving tower, I preferred carrying the armour towards the centre of the vessel to protect the battery, to incorporating it in the hull. The arguments in favour of the former plan appeared to me conclusive, always bearing in mind that to carry it into effect the cupola is not indispensable. The writer in the *Engineer* made this question turn on the difference between *fixed* and *revolving* armour, whereas the real point at issue is the advantage of carrying the armour away from the side and nearer to the centre, an arrangement incompatible with the incorporation in the hull of a weight intended to fortify the battery; but an arrangement which can be accomplished on a plan affording the means of training the guns as effectually as in a rotary tower without its disadvantages.

In an article on iron-cased shipbuilding, which lately appeared in the *Standard*, Mr. Reed's system was reviewed. By a coincidence which can hardly be fortuitous, that article, as well as the article in the *Engineer*, possess, in common, one characteristic. Purporting to be an impartial review of a plan, as a public question, both are made the vehicle of extravagant and fulsome eulogiums of the designer.

Some time since I put our legistators on their guard as to the insidious nature of this novel scheme of naval construction. I warned the country to be vigilant, and now, again, I see the necessity of protesting against the expenditure of public money on a class of vessels which never can be effective iron-clads. In whatever way, under whatever design their real character may be disguised, they are nothing more than *wooden ships* partially protected with armour. It is asserted that these vessels are to be "coated all over (*as completely as any of our larger ships*) with 4½ in. armour." Will Mr. Reed come forward and corroborate this statement by declaring that his vessels will be coated with 4½ in. plates and 18 in. of teak backing, like the "Warrior," or with 5½ in. plates to 9 in. of teak, like the "Minatour," *in addition* to the ordinary frames and planking which form the hull of the ship? I throw down this challenge and await the answer. I do not wish to mislead the public, and shall be only too glad to be set right if in error. My only aim is to prevent mystification on a subject which is little understood; and, to justify the course I am taking, I avow my belief that the Reed combination is a contrivance to revert to the construction of wooden ships.

Mr. Reed, or his advocate, is a bold man to choose this as the auspicious moment for urging Government to construct a fleet of combustible "wooden bottoms." Four and a half inches of iron, on 18 in. of timber, is a "Warrior" target without the iron skin or frames. It is a body without a back-bone or ribs. Rigidity in the mass, and cohesive resistance in the parts, two properties which constitute the strength of iron ships, are wanting in the Reed plan. Those who have watched the experiments at Shoeburyness and Portsmouth know that 68-pounders, even in single shots, fired at such a target as the iron-plated hull of the "Enterprise" represents, will splinter the planks behind the area of impact; and, if fired in broadsides, at short range, will smash in the hull over large spaces. If Mr. Reed has any doubt on this point, let him go to Portsmouth and examine the sides of the hulks, which have served as targets for testing armour plates. The trials on the "Warrior" section proved that it was the rigid resistance locally, and all over the *iron hull*, which mainly obstructed penetration. The Reed belt, as it is affectedly called, is the "Warrior" broadside without the iron hull. What its fate will be under fire may be predicted. At long ranges, rifled 7 in. shot will perforate the sides through and through, and rifled shell will lodge their incendiary charge in the wood and set the ship on fire. At shorter range, 5 in. rifled shell will produce the same effects. A salvo of five or six guns, much more a concentrated broadside of 68-pounders, will crush in so large a portion of the hull that, if between wind and water, the ship will be in imminent danger of foundering. Will Mr. Reed, who taxes those who doubt the perfectness of his system with not understanding the subject, deny the probability of these results? Will the Admiralty shut their eyes to the palpable and fatal weakness of iron-clad sloops and corvettes with wooden bottoms?

To leave no room for doubt, there is a way of solving the vital question. Let a target, representing a section of the "Enterprise" "belt," be constructed and experimented upon. I earnestly press this recommendation on Government, and, until it is adopted, shall perseveringly, as I did last session with reference to the Spithead forts, invoke the interference of Parliament to demand a target trial, before the keel of another "wooden bottom" be laid down. Mr. Reed may be a first-rate naval architect. I have no desire to dispute his title to that distinction. But he is of the wood school, and he is working to aid the Controller's department in prolonging the reign of wood in the royal dockyards. Regarding that attempt as official blindness, convinced that, if not checked, it will lead to an enormous and wasteful outlay, and to national disgrace, if not loss of England's supremacy on the seas, I raise a warning voice, hoping it may find its echo in the House of Commons. These alone are the motives which guide me, not any personal feeling towards Mr. Reed, whose experience, as a designer and constructor of wooden ships, does not qualify him to form correct notions on armour plating, which is the province of the mechanical or military engineer.

From the foregoing observations, and the tenor of all I have written on this subject, it will be seen I do not assail the Reed iron-clad as regards the lines and form of the vessel, but as a powerless wooden cruiser, incapable of holding her own against an armour-plated iron ship. If its author will defend it on this ground, we shall have a fair issue. But in his ardent advocacy of his invention, he thinks only of the cruiser, and loses sight of the war ship. He is a naval constructor, but not a naval engineer.

Mr. Reed, it appears, thinks that in condemning his class of iron-clads I am dealing with a subject I do not understand, and affects to treat my opinions as unworthy of notice. This is a convenient way of ending a controversy, but it will not effect its object. The evasion of the question is unwise. No writer, who commits himself in the press to the condemnation or approval of any act or measure, on public grounds, supported by facts and arguments fairly stated, is unworthy of notice. The subject assailed, or its author, is brought to the bar of public opinion, and it is no answer to a charge to tax the assailant with ignorance. If no better reply is given, the natural inference is, that the ignorance is on the other side. The facts and arguments adduced, remaining unrefuted, may be regarded as true.

This subject will be resumed in another letter.

I am, &c.,
CIVILIAN.

STRENGTH OF IRON AND STEEL.

SIR,—I was vexed to find that by some unaccountable mistake you omitted the most practical, and therefore the most valuable, suggestion which my manuscript contained—namely, that of making use of the heat given out by the waste steam, in order to warm the iron tires of railway wheels during frosty weather.

At present the steam is allowed to pass uselessly into the air. I would propose that in frosty weather it be carried along in a jointed pipe underneath the carriages, with small holes through which it would escape towards the wheels, which, as they revolved, might receive and retain sufficient of the caloric to prevent their becoming brittle by the frost.

As I feel convinced, that by such arrangement many accidents might be avoided, and much injury to person and loss of life prevented, I should feel obliged by your giving this insertion in your valuable paper.

I am, &c.,
CHAS. BATHOE.

28, York-place, Portman-square,
23rd January, 1863.

Meetings for the Week.

MON.—*Soc. of Engineers*, "On Boiler Explosions," by P. F. Nursery, Esq., at 7 p.m.
London Inst., General Monthly Meeting, at 2 p.m.

TUES.—*Inst. Civil Engineers*, "On the Sleeper Woods of the Madras Railway," by Mr. B. McMaster, at 8 p.m.
Royal Inst., "On Animal Mechanics," by Prof. Marshall, at 7 p.m.

WED.—*Soc. of Arts*, "On the Cooking Depots for the Working Classes, recently established in Glasgow," by A. Burrell, Esq., at 8 p.m.
London Inst., "On Commercial Law," by G. W. Hastings, Esq., at 7 p.m.
Geological Soc., 1, "On a Hyæna Den at Wookey Hole, near Wells." No. 2. By W. Boyd Dawkins, Esq. 2, "On the Discovery of Paradoxides in Britain," by J. W. Salter, Esq. 3, "On the Fossil Echinidœ of Malta," by T. Wright, M.D. 4, "Notes on the Miocene Bed," by A. L. Adams, at 8 p.m.

THUR.—*Royal Inst.*, "On Chemical Affinity," by Dr. E. Frankland, F.R.S., at 3 p.m.
Antiquaries, at 8.30 m. p.m.
Royal Soc., at 8.30 p.m.
Linnean, at 8 p.m.
Chemical, at 8 p.m.

FRI.—*Architectural Assoc.*, T. M. Rickman.
Royal Inst., "On Aerial Scientific Research," by J. Glaisher, Esq. at 3 p.m.
London Inst., "Chemistry," by F. Field, Esq., at 7 p.m.

SAT.—*Royal Inst.*, "On Life and Death," by W. S. Savory, Esq., at 7 p.m.

Gossip.

At the last meeting of the Liverpool Docks and Harbour Board, a communication from the secretary to Lloyd's was read, stating that, impressed with the necessity for some steps being taken to secure greater efficiency in the anchors and chain cables used in the merchant service in this country, they had passed a resolution in the latter part of last year to the effect, that to entitle a ship to be classed with the figure "1," her anchors should be proved to bear a strain equal to that known as the Admiralty test. That resolution, it was intimated, would come into operation on the 1st inst., and the committee had erected a proving house near the West India Docks at Poplar, and wished to know when the testing machine at Birkenhead would be ready for working. Referred to the Works Committee.

Mr. Donald Mc'Kay, in his report on the French navy, says the reason why iron war vessels are somewhat at a discount in France, is the insuperable difficulty of preventing their fouling. We have now another signal example of the same difficulty amongst ourselves:—The "Urgent," iron screw troopship, lately paid out of commission at Portsmouth, on her return from service in China, has been placed in dock at Portsmouth, and her bottom found to be covered with barnicles and other marine adhesions. The "Urgent" had been previously, during the term of her commission, carefully coated over her bottom with various so-called patent preservative compositions. The result has only been to coat her bottom with shell matter and weeds more plentifully than could possibly have been the case without them. We have before had occasion to remark on the apparent uselessness of these anti-fouling preparations, as illustrated by vessels docked at Portsmouth.

A general meeting of the Inventors' Institute will be held at the Polytechnic, Regent-street, on the evening of Monday, the 9th February next. We are informed that the Patent Law Committee of the Institute have completed their first report on the working of the laws relating to patents for inventions, which report will be published in the course of a few days. We understand also that arrangemants have been concluded for the use of rooms at the Polytechnic for the members' meetings, and we have no doubt that, under the management of its present council, which comprises many of our most noted inventors, and is presided over by that eminent man, Sir David Brewster, this institute will speedily take rank as one of the finest institutions in the kingdom. A large number of inventors and patentees have been already admitted to membership. The rights of inventors have always received our hearty support, and we shall have much pleasure in recording the success of the Inventor's Institute.

The following is the number of locomotives owned by each of the leading English railway undertakings. In the enumeration no account is taken of companies possessing less than fifty engines, and the figures, it should be stated, are brought down to the date of the latest return on the subject:—Bristol and Exeter, 60; Great Eastern, 328; Great Northern, 338; Great Western and South Wales, 413; Lancashire and Yorkshire, 363; London and North-Western, 972; London and South-Western, 177; London, Brighton, and South Coast, 145; Manchester, Sheffield, and Lincolnshire, 133; Midland, 475; North-Eastern, 446; North Union, 66; South-Eastern, 189; Stockton and Darlington, 151; West Midland, 104; Caledonian, 224; Edinburgh and Glasgow, 97; Glasgow and South-Western, 129; North British, 96; Scottish Central, 62; Scottish North-Eastern, 53; Great Southern and Western (Ireland), 92. The total number of locomotives at work in England and Wales at the date of the return was 4,956; in Scotland, 848; and in Ireland 352, making an aggregate of 6,156. Assuming that the average cost of each of those locomotives was £2,500, the capital invested in them would be no less than £15,390,000.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 1884, 1902.
BOILERS AND FURNACES, 1903, 1917.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 1906, 1915, 1926.
SHIPS AND BOATS, including their fittings, 1881, 1895, 1918.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 1878, 1921.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 1869, 1874, 1929.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 1870, 1872, 1877, 1886, 1889, 1890, 1901, 1907, 1909, 1911, 1913, 1916, 1922, 1923, 1927.
BUILDINGS AND BUILDING MATERIALS—*none.*
LIGHTING, HEATING, AND VENTILATING, 1876, 1880.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 1873, 1897, 1899, 1900, 1930.
METALS, including apparatus for their manufacture, 1885, 1896, 1919.
CHEMISTRY AND PHOTOGRAPHY, 1871, 1883, 1888, 1891.
ELECTRICAL APPARATUS, 1879.
WARFARE, 1898, 1908, 1925.
LETTER-PRESS PRINTING, 1882.
MISCELLANEOUS, 1868, 1892, 1904, 1905, 1910, 1912, 1914, 1920, 1924, 1928.

1868. J. WITHAM. *Improvements in the apparatus used in working oil and other hydraulic presses.* Dated June 25, 1862.

Here, in constructing the pumps of hydraulic presses, the patentee makes them double action instead of single action; that is to say, he makes them to force liquid to the cylinders of the presses, both in the up and down strokes; and, as is usual, more especially for oil presses, he employs two pumps, one of small diameter to give the finishing pressure, and one of large diameter to rapidly bring up the ram of the press. The details of the invention are voluminous. *Patent completed.*

1869. G. TURNER. *Improvements in mincing apparatus, such improvements being also applicable to machines for grinding coffee and spices.* Dated June 25, 1862.

This consists in the application to such machines of a moveable end plate for forming a second bearing for the spindle of mincing machines of the ordinary construction, such plate being secured in its place by means of two screws or pins, one of which is inserted in the upper part of the casing of the machine, and the other in the lower part of such casing, slots being formed in the moveable end plate for embracing such screws or pins. An aperture is made in the moveable end plate to allow of the exit of the minced material, as it is forced out of the machine by the action of blades formed on the revolving spindle, which is in the ordinary way. *Patent completed.*

1870. J. David. *An improved dynamometer for ascertaining the relative strength and elasticity of various kinds of thread and ropes.* Dated June 25, 1862.

In carrying out this invention a spindle charged with the material to be tested, say thread, is placed vertically upon a needle of relative strength working upon a centre, from which needle proceeds an arm acting as a lever; the thread is passed from the apex of the spindle over the extremity of the arm, which, being drawn downwards, will remove the needle from its vertical to a horizontal position. At the lever extremity of the needle is attached a weight of relative power to the strength of the thread or other material; as the needle is acted upon, by the time it has reached its horizontal position, the lever end will have described the finish of a circle. A graduated quadrant, to scale, whether of pounds or of more or less weight, is placed between the needle and the lower end of the needle at the moment of the thread breaking, will be locked by a latch upon the teeth out on the outer side of the quadrant. The point where the needle stops is indicative of the amount of force the thread supported before breaking. To show the elasticity of the thread, one end is attached to the arm, as above, the other held in the hand; the thread is acted on by a lever describing a smaller quarter-circle, which, at the moment the thread breaks, the amount of its elongation is indicated by the difference between the scales of the two quadrated quadrants. *Patent abandoned.*

1871. W. Clark. *An improved frame for holding photographic pictures.* (A communication.) Dated June 25, 1862.

These improved frames consist essentially of grooved bars, in which the pictures slide, and in which they are held in position, as described. *Patent completed.*

1872. W. Clark. *Improvements in apparatus for raising the nap on cloth and other fabrics.* (A communication.) Dated June 25, 1862.

Here the inventor substitutes a metal comb for the vertical teazle. This comb is formed of metal plates having hooked teeth, and these plates are fixed to a frame in rows, one above the other, similarly to the pickers of the pickers of the teazle. The frames carrying the comb teeth may be of metal, or other substance. *Patent abandoned.*

1873. E. T. Hughes. *Improvements in regulating or moderating the movement of the keys of pianofortes.* (A communication.) Dated June 26, 1862.

In carrying out this invention, a spring is fixed by a screw at the back part of each key of the key board, and in order that the said spring shall not be turned aside either to the right or left, its moving extremity is curved, and traverses a lined hole in the key, which allows it to move as a piston, and without noise. Above the back part of the keys there is a bar extending the whole length of the key board from the bass to the treble. The top of the bar works upon pivots, so that it can be moved to and fro, and its lower surface rests upon the springs. When the bar rests upon the part of the springs most distant from their fixed ends, a slight resistance is given to each key, which resistance is increased in a progressive manner as the bar is made to recede towards the fixed ends of the springs. The said bar is moved to and fro, as required, by a rack gearing into the teeth of a toothed segment fixed to the bar, motion being given to the rack by a screw upon a rod, the plain part of which works in a collar, and extends to the front, and has at its extreme end a socket for a key, by which the screw may be turned. Attached to the rack, or to the bar, there is a plate of metal, or other material, in connection with a scale, or gauge, placed in sight, at the front part, for the purpose of indicating the position of the bar, and the resistance given to the keys. Thus, by turning the screw, so as to move the rack backwards, resistance is given to the keys of the key board, and, by reversing the motion of the screw, the resistance is diminished. *Patent abandoned.*

1874. G. Peterson. *Improvements in apparatus for ascertaining the quantity and strength of spirits or other products obtained by the process of distillation.* (A communication.) Dated June 26, 1862.

We cannot here quote the details of this invention. *Patent completed.*

1875. S. R. Trebutt. *Certain improvements in the manufacture of soap and soda and other material employed for the purpose of washing and cleansing.* Dated June 26, 1862.

This invention consists in the novel employment and use of such oils or spirituous extracts, petroleum, camphine, rock oil, paraffin, naptha, and other such similar oils and spirits procured from wood, and progressing detergent properties. The oils or spirits are to be mixed and incorporated with the washing material in any required proportions to increase the cleansing or detergent powers thereof. *Patent completed.*

1876. J. Parkes. *Improvements in gas lanterns.* Dated June 26, 1862.

This invention relates to that class of lantern suitable for suspension in railway stations and other public places, and are of a globular form; the framework consists of a series of segmental ribs, to which the glass is fitted and makes up the globular form, each piece being of the section of a sphere. The patentee employs three rings in the frame—two small ones, one each at top and bottom, and one large one at the middle or equatorial line. The small rings he makes of a thin strip of metal presenting the edge to the light, and consequently to throw little or no shadow. The middle bead is unlike that in ordinary use, being narrow and without openings—the only openings in the lamp being above and below the one at the bottom for admission of the air, and the other at the top for the escape. The section of metal of which he forms the segmental ribs, and the large ring, consists of a flat strip with a hollow head united thereto on the outside, the whole being kept as narrow as consistent with the strength necessary. He supports this lamp with three rods united to the middle bead, and meeting at top in a single pendent arm or branch; or they may be otherwise supported. From the absence of apertures in the middle bead, and the disposition of the metal in its upper and lower rings and ribs, which are few in number, comparatively little surface is presented to intercept the radiation of light, and, consequently, little or no shadow is thrown. The gas duct passes down one of the arms to the mid ring, and there enters the globe, and descends to a suitable position for the jet. The stop cock he prefers to place immediately under the jet, and concentric with the lower opening in the lamp, the elbow being formed with a stop cock in which the gas passage emerges at one end of the axis, with a view to that object. The parts of the frame are united by soldering, brazing, or otherwise, and the glass, which is inside the frame, is fixed by means of metal strips coinciding with the ribs and large middle ring, and fixed thereto inside and upon the edges of the glass; or the glass may be fixed with putty and otherwise in the ordinary manner of fixing the glass in similar kinds of lamps. *Patent completed.*

1877. J. B. Coquatrix. *Improvements in weaving carpets, tapestry, and similar fabrics, and in apparatus for the same.* Dated June 26, 1862.

This invention consists in the passing of the warp threads through two reeds fixed opposite each other in the batten of the loom. By using two reeds instead of one—as is usual in weaving all kinds of fabrics—the patentee is enabled to use a much larger number of threads, and also of producing, by an arrangement of the warp, a tapestry stitch which has, hitherto, only been effected by hand. The stitch of which the improved carpets are made is that termed Gobelin stitch or fine tapestry, done with a needle. He thus obtains a much more regular and stronger work than that done by hand. The designs which he weaves at the present time are suitable for arm and other chairs. *Patent completed.*

1878. J. Martin. *Improvements in reaping and mowing machines.* Dated June 26, 1862.

This relates to improvements in reaping and mowing machines, and consists in accumulating the motive power in one or more springs, by which means the cutters are caused to operate with equal speed and effect, whatever may be the rate of speed at which the machine is driven. *Patent abandoned.*

1879. J. H. Johnson. *Improvements in the construction of electric-voltaic plate 'work. for medical and other purposes.* (A communication.) Dated June 26, 1862.

This invention relates to a peculiar construction and arrangement of articulated or flexible electro-voltaic plate work, intended for the cure of certain bodily complaints, and applicable in various forms, suitable to be worn about the person, but more particularly in the form of an inner sole to be worn inside boots or shoes. The essential feature of this invention is the forming of articulated electro-voltaic plate work in various sections throughout the whole major portion of its area, by using two or more tiers of negative plates in preference to one, and interposing between such plates a series of positive plates, or by using two or more tiers of positive plates, and interposing between a series of negative plates. The upper and lower plates should be so divided and kept separate longitudinally and transversely as to establish a multiplicity of negatives and positives, with their contiguous edges exposed and breaking contact. The several sections of the positive and negative plates are connected or hinged together by a flexible insulating strip or strips of india-rubber, or other suitable material, united to the sectional plates by metallic or other eyelets. But in order to give a more united character to the whole, and facilitate the manufacture, it is preferred to connect the sections of plates by a single insulating strip made with perforations or openings therein, so as to be of a skeleton form, and admit of the positive and negative plates, or rather those sections which lie one under the other coming in contact, and establishing electrical action between or by the said plates or plate sections. *Patent completed.*

1880. J. H. Johnson. *Improvements in fluids to be used for illuminating purposes.* (A communication.) Dated June 26, 1862.

This consists in the production of a new illuminating fluid, consisting of a combination of a fusel oil, petroleum, paraffin, or coal oil and alcohol, or of such alcohol as is known as methylated spirit. The proportions, as at present found suitable, are four quartz of fusel oil, one quart of refined petroleum, paraffin, or coal oil, and about a pint of alcohol, or of methylated spirit. The fusel oil before being mixed with the other oils, is purified or cleansed by being washed with water; after the water which has been used for this washing process is drawn off, the petroleum, paraffin, or coal oil, is added to it, and the alcohol being then added, produces a chemical combination, and a fluid fit for burning purposes. *Patent abandoned.*

1881. A. Anderson. *Improvements in apparatus for steering ships and other vessels.* Dated June 27, 1862.

Here the rudder head is furnished with a tiller or lever arm, to which the ends of ropes or chains are attached, which pass in opposite directions around blocks or pulleys, carried by arms or projections fixed to the deck or other part of the vessel. From the sheaves or blocks, the ropes or chains pass to and around a grooved drum or barrel, to which the other ends of the ropes or chains are fixed. The grooved drum or barrel is carried by a vertical (or it may be in any other position) shaft or axis, supported in fixed bearings, and on the upper end of this axis a toothed bevel wheel is fixed, which takes into, and is driven by, a bevel pinion fixed on a horizontal axis, upon which the hand or steering wheel is fixed, and by which motion is communicated to the rudder when required. *Patent abandoned.*

1882. J. Watson. *Printing sheets of paper from letter-press forms, stereotype blocks, and wood engravings.* Dated June 27, 1862.

This consists in the general design of the mechanism and arrangement of the parts of the apparatus by which the following advantages are obtained, that is to say:—1, Printing from both sides of the cylinder, taking one impression from the letter-press forms, blocks, and wood engravings, as they pass under the said cylinder from left to right, and another as they return from right to left, and so on continuously. 2, By so constructing the cylinder and feed and delivery rollers and apparatus in connection therewith, that the whole can be instantly lifted by a hand lever, moved to the right or left, so as to cause the paper to pass through the machine without taking an impression, in the event of its becoming deranged in the laying-on operation. 3, In giving a reciprocating motion to the table carrying the letter-press forms, blocks, &c., and inking boards, by the running gear, without any additional reversing mechanism. 4, Causing the said apparatus to start the sheets upon the laying-on boards at each return of the tables from the left to right, and *vice versa*, by adjusting spring catches and levers. 5, By such adjustment adapting the same cylinder and table for printing sheets of various sizes. *Patent completed.*

1883. C. Cockrane. *Improvements in the manufacture of aluminate of soda and potash.* Dated June 27, 1862.

Here slags obtained from the blast furnace used in the manufacture of iron, are reduced to a powdery form by any of the well-known methods, the best being first to run the slag whilst in a molten state direct from the blast furnace into water. 2, To dry the wet friable slag thus obtained. And, 3, To crush it when dry between a pair of cylinder rollers. The dry, crushed slag is now intimately mixed with a salt of soda or potash, in the proportions of one part of the dried salt (the carbonate of soda or potash being preferred), to four parts by weight of slag, containing about 23 per cent. of alumina. These proportions, however, may be varied, and should vary with the percentage of alumina in the slag. The mixture thus obtained is next thrown upon the hearth of an ordinary reverberatory, or other suitable furnace, in quantities varying of course with the size of the furnace—say, from four to seven cwts. a charge—and these subjected to a temperature somewhat above cherry red heat, but falling short of actual fusion of the ingredients in the furnace, which are to be repeatedly stirred by the workman, so as constantly to expose fresh surfaces to the action of the heat. The completion of the process is ascertained by removing, from time to time, a small quantity of the contents of the furnace and testing it with acid, using by preference hydro-chloric acid. When effervescence ceases on the addition thereof, the materials are drawn from the furnace, and next subjected to the well-known process of lixiviation, by which the soluble ingredients of the products of the furnace, namely, the aluminate of soda or potash, is dissolved out; the liquor containing the salt is then decanted into an evaporating pan, which may be either heated from above or below, and the aluminate of soda or potash obtained therefrom by evaporation. *Patent completed.*

1884. E. Hunt and H. D. Pochin. *An improved condensing apparatus.* Dated June 27, 1862.

This consists in an improvement in separating and depositing resinous or fatty matter, which has, for the purpose of distillation, been converted into a state of vapour by an admixture of steam. This is effected by disposing in the interior of a metal box, furnished with metal partitions, and surrounded by a water or steam-tight jacket, a series of perforated copper plates, against which the admixture of steam and such resinous or fatty matters is made successively to impinge, and in which the resinous or fatty matters are arrested, while the steam is allowed to pass out of the condenser. *Patent completed.*

1885. C. Cockrane. *Improvements in the manufacture of iron.* Dated June 27, 1862.

Here aluminate of soda or of potash is used in order to purify and improve the manufacture of iron. It is preferred that the aluminate of soda or potash should be to and mixed with iron when in the melted state, and when the iron is about to be puddled; but the application of the aluminate may be at a different part of the process of the manufacture of iron to that above named. *Patent abandoned.*

1886. J. Lord and J. Brown. *Certain improvements in power looms for weaving.* Dated June 27, 1862.

This consists in a method of effecting the stoppage of the loom when the shuttle does not enter the shuttle box. Upon the ordinary stop rod of the loom the inventors fix a vertical rod projecting downwards, and forming a bell crank lever with the stop rod tongue; and upon this rod a spring is fixed, which is acted upon by a stud on the crank arm at each beat up; also on the rod and beneath this spring a projecting finger is arranged so as to come under a bowl on the framing for the purpose of holding the stop rod tongue out of contact with the frog during the traverse of the shuttle. When the shuttle enters the boxes as required, the spring yields to the stud on the crank arm; but when the shuttle omits to enter the box at the proper time, the back finger on the stop rod, not being sustained by the swell of the shuttle, is at liberty to fall inwards, so that, when the stud on the crank arm lifts the spring at the next beat, the vertical rod is moved by the spring, and turns the stop rod sufficiently to throw the stop rod tongue into contact with the frog, thereby effecting the stoppage of the loom. *Patent abandoned.*

1888. R. A. Brooman. *A method or methods of preparing paper for the reception of photographic pictures, or impressions may be transferred to and fixed on wood, porcelain, and other surfaces.* (A communication). Dated June 27, 1862.

The details of this invention are too voluminious to be quoted here. *Patent completed.*

1889. A. H. Martin. *Improvements in means or apparatus employed in weaving.* Dated Jnne 27, 1862.

The object here is to obtain increased uniformity or evenness in the winding on or taking up of the cloth. For this purpose the workbeam is borne with the surface of the cloth thereon to the surface of the top beam, or first drawing roller, by weighted or other suitable pressure, and the two beams are geared together by frictional gear, adapted to admit of slip as the diameter of the cloth beam increases by the quantity os cloth wonnd thereon. And to compensate for the consequent difference of distance of the axe of these two rollers or beams, the patentee forms the teeth of the gear of length to admit of such increase of distance without the teeth of the respective wheels separating one from the other. *Patent completed.*

1890. J. Holden. *Improvements in means or apparatus for preparing and combing wool and other fibrous materials.* Dated June 27, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1891. A. A. Croll. *Improvements in the treatment of ammoniacal liquor of gasworks.* Dated June 27, 1862.

This invention has for its object economy in the treatment of ammoniacal liquor of gasworks when obtaining salts of ammonia; as also the avoidance, or great mitigation, of the inconvenience and annoyance arising from the treatment of such liquor. Steam, from a suitable boiler, is conveyed into ammoniacal liquor contained in a suitable closed chamber, and the combined vapour and steam resulting are conveyed from the upper part of this chamber into other ammoniacal liquor contained in another closed chamber, placed somewhat higher than the preceding, in order that, as the ammoniacal liquor in the previous chamber becomes spent, it may be supplied from the second, and, if desired, other number of such ammoniacal chambers may be employed. From the last ammoniacal chamber, the vapour resulting, combined with particles of steam, are conveyed into a closed compartment, or chamber, of a vessel containing acid adapted to the salt of ammonia desired to be obtained. Thus, supposing the salt desired is sulphate of ammonia, then this last chamber will contain sulphuric acid, and it is, at its upper part, divided into two compartments, one open at the top, the other closed by a cover, and a partition dipping below the surface of the acid liquid therein, and below the mouth of the pipe conveying the vapour and steam thereto from the last ammoniacal chamber. Any vapour arising from the closed compartment of this vessel is conveyed into similar acid in another closed chamber used as a reservoir. From the upper part of this last closed chamber the sulphuretted hydrogen liberated is conveyed to the furnace supplying a vitriol chamber. *Patent completed.*

1892. D. L. **BANKS.** *A method of constructing a portable covered coffer-dam, or apparatus for facilitating operations under the water, in the water, or out of the water, and apparatus connected therewith.* Dated June 27, 1862.

We cannot here give space to the voluminous details of this invention. *Patent abandoned.*

1893. D. L. **BANKS.** *A method of constructing a portable sectional dry dock, and apparatus connected theirein.* Dated June 27, 1862.

We cannot here give space to the details of this invention. *Patent abandoned.*

1895. T. **KING** and J. **KING.** *Improvements in agricultural machines.* Dated June 28, 1862.

This consists, 1, Of an agricultural machine for loosening the soil (it may be after it has been broken up by ploughing or by a scuffle), and bringing to the top of the soil whatever rubbish, such as twitch or weeds, the soil may contain. The said machine is constructed essentially as follows:—Upon a frame mounted on travelling wheels a revolving barrel or roller is supported, to which a horizontal revolving motion is given by the travelling wheels, the said barrel or roller being geared to the travelling wheels by toothed wheels or other gearing. On the cylinder surface of the said barrel or roller, spikes or tangs are fixed in a radial direction. As the machine is drawn over the land, the barrel or roller revolves, and the spikes or tangs enter the soil nearly to the depth to which it had been previously broken up by the plough and scuffle. The said spikes or tangs in passing through the soil lessen it, and on rising out of it, bring out the twitch and weeds, and throw them on the surface of the soil, from which they may be removed, or where they may be left to perish. 2, In applying a moveable collar roller to the prongs of scuffles or the coulters or other like parts of agricultural machines. The said collar or roller is applied to or fixed on the prong or coulter, and turns on a vertical axis. The said collar or roller prevents the prong or coulter carrying with it soil, or anything which impedes its proper working, and it is very useful on clay soils. *Patent abandoned.*

1896. C. **BESLAY.** *Improvements in galvanizing or coating metals by electro-chemical agency.* Dated June 28, 1862.

This relates to improvements upon a former patent, granted to the present patentee, Jan. 12, 1859 (No. 103), and consists in the galvanization of metals, more especially cast or other iron and steel, by indirect means at the ordinary temperature with non-concentrated solutions, which he terms galvanization in a cold state. *Patent completed.*

1897. G. H. **HULSKAMP.** *Improvements in pianofortes.* Dated June 28, 1862

The patentee states that some degree of tension in the sounding board produces a striking effect upon the quality and volume of its tone, and the best effects are produced when some relation exists between the tension of the strings and the strain upon the board; and this invention consists in applying this principle to pianofortes of different kinds. The patentee can dispense entirely with the iron bars usually placed above the strings in grand pianos, but he prefers to cover the wrest and hitch plates with a thin solid metal frame. The strain of the strings on one side of the frame is counteracted by an unequal strain of the sounding board on the other. An equilibrium is maintained between the two. Any excess or variation of the tension on one side is, in a measure, communicated to the other, and a proper relation between the two sustained. The invention is not fully described apart from the drawings. *Patent completed.*

1898. J. **GARNIER.** *Improvements in ordnance and in projectiles.* Dated June 28, 1862.

The documents relating to this invention cannot at present be seen, an extension of time for filing the final specification having been petitioned for.

1899. G. W. **BELDING.** *An improved flexible spring cloth or fabric adapted for the manufacture of ladies' skirts.* Dated June 28, 1862.

In producing this cloth ebonite is combined with the ordinary materials of which cloth is composed, either in the process of weaving or felting, or by attaching strands of ebonite to manufactured cloth by sewing. *Patent abandoned.*

1900. C. **CALLEBANT.** *Certain improvements in sewing machines.* Dated June 28, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1901. J. **TATHAM.** *Improvements in machinery or apparatus for preparing, spinning, doubling, and winding cotton, wool, and other fibrous materials.* Dated June 28, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1902. J. **PETRIE.** *Improvements in slide valves for steam engines.* Dated June 28, 1862.

This invention consists in forming the slide valves of steam engines with cylindrical faces, so that they may be capable of turning upon centres of motion; and this turning the inventor effects by means of tappets or other ordinary apparatus connected to a moving part of the engine. In addition to this rotatory motion the valves slide as usual; but by the first-described arrangement the steam may be cut off at any part of the stroke. The valves may constitute a portion or the whole of a cylinder, and in the latter case he avails himself of the back part thereof for packing, whereby a portion of the steam pressure is removed. *Patent abandoned.*

1903. J. **WEBSTER.** *Improvements in the means of protecting steam-boilers from incrustation.* Dated June 28, 1862.

This invention consists in causing the earthy and saline matters which heretofore have been deposited on the boiler to be precipitated by electric currents on another surface. One mode of carrying out the said invention is to set up an electric action by the contact of two metallic surfaces. Thus, in an ordinary steam-boiler, the inventor places in contact with each other a sheet of copper, and a sheet of zinc (these he mentions as the metals he believes to be most suitable); these he immerses in the water in the boiler, and he insulates them, as far as metallic contact is concerned, from the boiler. It will then be found that all the earthy and saline matters held in solution in the water will be deposited on the said copper plate or plates, which can from time to time be taken out of the boiler for the purpose of cleansing. The entire interior surface of the boiler will thus be preserved clean. *Patent abandoned.*

1904. N. **THOMPSON.** *Improvements in apparatus for stopping bottles, jars, and other vessels, and in instruments for applying and removing such stopping apparatus.* Dated June 28, 1862.

For the purpose of stopping bottles, jars, and other vessels, the inventor employs a cover or stopper of suitable rigid and non-porous material, which enters into the neck of the bottle or jar, and fits on to or into a seat therein, an elastic material being interposed between the two surfaces. Connected with the top of the cover or stopper, but so as to be capable of turning freely, is a screw which passes through an outer lid; this also fits into the neck of the bottle or jar, and it is notched at its periphery at three, four, or other convenient number of points, and the interior of the neck of the bottle or jar has corresponding projections upon it, so that the lid can only be dropped into its place when turned into such a position that the notches therein correspond with the said projections, when it can be turned round, and then, by rotating the screw, the lower can or stopper is forced down, and a tight joint made. There are recesses in the rim of the upper lid into which the projections in the neck of the bottle or jar drop when the lower cover or stopper is forced down by the screw, so that the lid becomes secured, and cannot be turned until the screw is again slacked; a key is employed to turn the screw, which may, if desired, be protected by a seal or capsule or otherwise. *Patent abandoned.*

1905. J. **WALL** and T. **DODD.** *Improvements in taps for controlling the flow or passage of fluids.* Dated June 30, 1860.

The patentees claim, firstly, the construction of taps or cocks with one valve working between two seatings, substantially in the manner described. Secondly, the construction of taps or cocks with a thimble or cap, having apertures therein for the passage of the fluid, over the internal surfaces of which apertures the whole or part of the outer surface of the valve must travel either in opening or closing, substantially in the manner described. *Patent completed.*

1906. W. **THOMAS.** *Improvements in the running gear of four-wheeled carriages.* Dated June 30, 1862.

The body of the omnibus—which may be made of any convenient form—is supported by springs of any known kind, resting on, suspended from, or in any way attached to the axles, and the carriage parts are fitted in the ordinary manner. On the axle, near the inner ends of the naves of every wheel, are secured brackets which carry studs, pins, or bolts for receiving the ends of the tension rods of the equirotal lock arrangement or system. These rods are made preferably of metal, and are carved diagonally from the near fore to the off hind wheel, and from the off fore to the near hind wheel. To prevent friction and flattening of such tension rods, the patentee uses four or more friction rollers, so arranged in a frame or bracket that the said rods shall be kept a sufficient distance from each other, and the friction reduced to a minimum, both in turning, and during the shaking and jolting in straight running. The gear to which the pole of the omnibus is fixed, as well as the gear permitting quick turnings to be made, is the same at both ends, and the main parts of each end consist of four metal tension rods, two or more elliptical shaped or otherwise formed metal bars, rods, or springs, a futchel piece, and a curvilinear metal forging, with a bracket or brackets and friction roller or rollers thereon. All the tension rods are jointed on studs, pins, or bolts, secured by brackets or otherwise to the axle, two at or near each end of the same, and close to the inner ends of the naves of the wheel. One of these tension rods at each side is carried forward to or near to the front or end of the omnibus, and is there coupled by a joint to two or more elliptical or other metal bars, rods, or springs. The other two tension rods are carried forward, and almost meet near the centre of the said elliptical or other bars, rods, or springs, and the futchel piece or socket for the pole is secured in the same position; that is, equi-distant from the ends of the elliptical or other bars, rods, or springs. The bracket or brackets is or are secured or jointed to the said futchel piece, to the elliptical or other bars, rods, or springs, or to both or either of them, and pass and encompass a curvilinear or other suitably formed metal forging principally in a horizontal position, made fast by flanges or otherwise to the bottom of the body of the omnibus. This curvilinear piece, which carries the whole of the fore draught gear, allows the bracket or brackets, and the elliptical or other bars, rods, or springs, as well as the tension rods, to travel or move laterally a sufficient distance for quick turning of the omnibus, friction being diminished by a roller or rollers in the ends of the said bracket or brackets. A further improvement in running gear consists in making the naves of the wheels of the kind known as the "patent mail wheel" of iron, instead of iron and wood combined; the sockets for the wooden spokes being cast or formed in the nave. *Patent completed.*

1907. J. **HARTSHORN.** *Improvements in the manufacture of lace.* Dated June 30, 1862.

One part of these improvements relates to employing extra threads, operated by bottom guide bars (when two sets of guide bars are used), in combination with extra stump bars or spaces for such threads, by which such threads so operated may at times be used to produce looped, purl, or open edges to holes, and at other times be used to produce, increase in substance, or other effects in or upon the body of the fabric. The tension on such threads is regulated as required. Another part of these improvements relates to producing in machine-made lace holes inclined or at angles to the selvage of the fabric, by the working of certain of the warp threads operated by figuring or embroidering bars, and supplied from the main beam, such threads being caused to loop with certain of the bobbin threads at the whole or holes to be diverted or drawn, and then to traverse in and form part of the body of the fabric to a distance sufficient for the required tension. *Patent abandoned.*

1908. A. **BYRNE.** *Improvements in breech loading fire-arms.* Dated June 30, 1862.

This invention is carried into effect as follows:—About four inches in length of the breech end of the barrel is bored out somewhat larger than the principal part thereof. At the junction of the two sizes of bore a conical seating is formed for the purpose of receiving a plug or stopper. Immediately before such seating is placed the ordinary percussion nipple, and behind the same an opening is made by cutting a gap on the top side about three inches in length, and about one third of the diameter of that part of the barrel in depth, leaving about one inch in length behind the opening to receive the breech piece, and form an abutment for the plug or stopper. The sides of the opening are cut away to the full width of the bore, and grooved for a purpose hereinafter stated. A plug or stopper about one inch in length is fitted to the bore within the opening, free to slide the full length thereof, and shaped to fit the conical seating air tight when pushed forward. One part of a hinge is projected on the top side of such plug (behind the conical part) unto which is attached a flap or cover, so shaped as to close the opening, and to fill up that part of the bore between the plug and the back end thereof, thereby completing an abutment for the plug or stopper (quite independent of strain upon the hinge pin) when the flap is shut down. A guard piece is fitted to the plug, and made to slide in the grooves before mentioned to keep the same from rising when drawn back, and admit a cartridge. The flap is fitted with a self-closing spring bolt, such bolt being acted upon by a cranked spindle (or its equivalent), with an arm or lever attached, and so arranged as to withdraw the bolt from the fastened position when the lever is lifted up, and to close and securely fasten the same when the lever is let down. In the latter position only is it possible to get the hammer to the full bent ready for firing. These parts are altogether so arranged that, by one act, the bolt is withdrawn from its fastened position, the flap opened, and the plug or stopper drawn to the back end of the opening, making room in front to admit a cartridge. And when the cartridge is inserted by one act, the plug is pushed up to the seating, carrying the cartridge before it into the barrel, and the lever shut down and securely fastened safe and ready for firing. *Patent abandoned.*

1909. W. E. **GEDGE.** *Improvements in looms for weaving.* (A communication.) Dated June 30, 1862.

This invention consists of improvements in that part of a loom known as the cording or tie up machine or apparatus, and permits working with as many lames as the loom will carry, and with a repetition of, say, thirty treadles. The object of this tie up machine is, therefore, to give the facility of making on power looms figured fabrics which have hitherto only been made by the hand loom. *Patent abandoned.*

1910. W. F. **MURRAY.** *Improvements in the manufacture of stoneware bottles.* Dated June 30, 1862.

According to the improved system or mode of manufacture the material of which the bottle is composed is formed with an inwardly projecting part a short distance below the mouth. This projection forms a smooth swell or bulge, which facilitates driving of the cork into the bottle, and grips it at the central part in such manner as to effectually exclude air, at the same time the expansion of the cork below the projecting part of the neck prevents the cork from becoming loose, or being driven out by accident, or by the expansion of the fluids. *Patent abandoned.*

1911. W. E. **NEWTON.** *Improved apparatus for picking or gathering cotton.* (A communication.) Dated June 30, 1862.

This invention cannot be described apart from the drawings. *Patent completed.*

1912. W. **EASTON** and G. **DOUKIN.** *Improvements in lears or annealing chambers, and apparatus used in annealing glass.* Dated June 30, 1862..

Heretofore lears or annealing chambers have, in some cases, been made in such manner that the apparatus or beds on which the glass is piled or placed have been moved horizontally through a considerable length of a chamber or lear, wherein the heat has progressively decreased. Now, according to this invention, a lear or chamber is constructed with an ascending and a descending limb, which are connected at their upper ends. The succeeding beds or surfaces on which the glass is placed or piled are raised in the ascending limb, and having arrived at the upper part of the ascending limb they pass to and then down the descending limb of the lear or annealing chamber. The ascending limb of the lea is heated, and the requisite heating of the glass takes place therein, and in the top part of the chamber. The temperature of the descending limb decreases from the upper part downwards. It is preferred that the series of beds or surfaces on which the glass is placed or piled should be connected together, in order that those in the ascending limb may be counterbalanced by those in the decending limb of the lear or annealing chamber. The two limbs are connected also at their lower ends, and provision is there made for the surfaces or beds as they are unloaded to pass readily from the descending limb into the lower part of the ascending limb of the lear or annealing chamber, in order to their being again loaded before they again ascend in the ascending limb. It is not, however, essential that the several beds or surfaces on which the glass is placed or piled should be connected together, as provision may be otherwise made for raising and lowering them in the ascending and descending limbs of the lear or annealing chamber respectively. *Patent completed.*

1913. T. **Parker.** *Improvements in tinting or dyeing fabrics composed of mixed animal and vegetable fibres.* Dated June 30, 1862.

In carrying out this invention, fabrics which are composed of mixed animal and vegetable fibres, such as those woven with cotton warp, wefted with wool, or with alpaca, or with other animal fibres, and also other fabrics wherein are used a combination of animal and vegetable fibres, are treated in the following manner:—The fabrics are first well scoured and thoroughly cleaased; twey are then, in a moist state, introduced into and stoved into a sulphur stove, the fabrics being kept open or extended whilst in the stove. The fabrics are then taken from the stove, and without extracting or removing the sulphur they are caused to pass through water, and then through the dye liquor. In performing this process it is important that the fabric should be kept open and passed horizontally through water. It is subjected to pressing rollers as it comes out of the water. It is also important thai it should then be passed in an open state horizontally through the dye liquor, and be pressed between pressing rollers as it comes from such liquor; the fabric is then to be dried. By these means not only will the fabric be very evenly tinted, but at the same time it will have a high finish communicated to it, the animal and vegetable substances in the fabric being similarly tinted or dyed. *Patent completed.*

1914. J. **Parkinson** and J. **Marsland.** *Improvements in apparatus for regulating the flow and pressure of steam and other fluids.* Dated July 1, 1862.

This improved apparatus is particularly applicable as a reducing valve, that is to say, as a valve for reducing the pressure of steam from that in the boiler or other receptacle to the pressure required for heating or other purposes. The apparatus consists of a hollow piston or plunger, open below, which fits in a cylinder, corresponding holes being made in both; the cylinder is secured in a box or casing furnished with inlet and outlet pipes or passages. A spindle from the hollow piston or plunger passes through the cylinder and casing, and it is weighted according to the difference in the pressure between the in-coming and outgoing steam or other liquid. When the improved apparatus is used as a throttle valve, the spindle of the piston or plunger is connected to the governor, so that when the governor-balls expand or collapse the piston or plunger is raised or lowered in the cylinder, thereby contracting or expanding the passage for the steam through the holes in the piston or plunger and the cylinder. In this case the piston or plunger, instead of being closed above, is left open, and the spindle is connected to a cross bar, and passes through a stuffing-box in the casing. *Patent abandoned.*

1915. E. F. **Prentiss.** *Improvements applicable to omnibuses and other vehicles.* Dated July 1, 1862.

This invention relates to a peculiar arrangement and mode of applying the running gear to four-wheeled carriages, to facilitate their turning, and that they may be driven either end foremost. And also to a peculiar construction of light body for passenger carriages, which it is proposed to call the "skeleton" or "spider" chariot. The first part of these improvements consists in constructing and fitting both the front and hinder axletrees of four-wheeled vehicles in sucn a way that they will both turn horizontally round on their vertical axle pins (or "perch bolts") a given distance, and in connecting the two axletrees together by two crossed connecting rods. One of these rods the patentee joints to the front axletree near the nave of the near wheel, and carries it across to the hinder axletree, and joints it thereto near the inner side of the off wheel, and the other rod he joints to the front axle near the off wheel, and which he also extends to the hinder axle, to which he joints it, in like manner, near the inner side of the near wheel. By this arrangement, it will be readily seen that, if the leading wheels are turned towards the left, the two wheels on the left side of the carriage will be brought towards and at an angle to each other, and that the two wheels on the right side of the carriage will be proportionately separated from each other, when the carriage can be readily turned toward the left; and, by turning the leading axle toward the right, the reverse motion will take place in the wheels, and the carriage can be turned in the opposite direction. The second part of the invention relates to the construction of light carriage bodies for open passenger vehicles, and consists in a light parallelogramical frame of wood, angle iron, or other suitable material, between and from the longitudinal sides of which spring a number of light arched spanners of wood, fitted with metal tie rods, or they may be constructed entirely of metal. On the crown of the arched spanners he constructs a vertical longitudinal railed, or other suitably shaped back, for longitudinal seats, fitted on each side thereof. The seats, he prefers, should be cane-seated frames, fitted with loose cushions. The foot rests, and the stages at each end of the body he proposes to form of light open grating framework, and to surround the whole with a light rail, or light open frames, or closed panelwork, except at the openings left for ingress and egress. He further proposes to erect two or more standards, extending above the centre back rail, for supporting a suitable double hood, which can be let down at both or either side of the carriage. *Patent completed.*

1916. E. **Pourpoint.** *An improved wool washing machine.* Dated July 1, 1862.

This improved machine is composed of a wooden framing, on which is suspended a basin pierced with holes, and four cast-iron brackets with copper or brass bearings receive two shafts of square iron, but with the extremities rounded so as to be placed on the bearings. These shafts carry two pulleys, one fast and one loose (or a crank may be substituted when hand power only is at command). The fixed pulley on each shaft causes the two shafts to work together by the aid of a cross band, so that the movement of the four hollow copper arms (by which the wool is to be kept in agitation) are opposed to each other in such wise that the wool, which is driven by the arms on the right, is pushed back by those on the left, and is thus kept uniformly thick in the basin. Each end of these arms forms a curve, so as to slide on the wool in displacing it, without, however, lifting it out of the water. These arms are of hollow copper, rather than of solid iron, in order that they may work more lightly, that the wool may not be pressed or pulled, and because the scouring, which is usually effected with soda or acids, would oxydize iron and damage the wool. These four arms are bolted crosswise, two on each shaft. The bottom of the said machine is of non-oxydisable metal, and is pierced with small holes for the escape of the dirt from the wool. It is fixed on two iron bars, flat at the edge from end to end, and is supported by bolts at each corner of the framing. A pipe is placed in the interior, and from it pure water is poured on the wool, and enters the basin. The water should rise about 24 in. above the bottom, about 8 in. being left between the bottom and the end of the arms, in order that the dirt may issue freely through the holes in the bottom, the wool floating in the upper part during the beating. A cap is fitted on the framing to retain in the basin any wool which might otherwise be thrown out during the working of the arms. The machine is placed in a wooden basin or reservoir, deep enough to hold about 16 in. of water and receive the dirt from the wool. This reservoir may be replaced by one in masonry. In using this machine in a watercourse the reservoir would be surpressed, and two would be adapted side by side at the bottom of the copper basin. Lastly, a pipe is fitted to this crushing machine to permit any excess of water to escape, and serve at the same time for exit of the dirt as it is deposited. *Patent abandoned.*

1917. R. A. **Brooman.** *Improvements in the construction of blast furnaces.* (A communication.) Dated July 1, 1862.

The object of this invention is to enable the lower portions of blast furnaces, and those subjected to most wear, to be removed when necessary, and replaced by similar and duplicate portions, without materially interfering with or stopping the working of such furnaces. The invention consists, 1, In the construction of blast furnaces in two parts, one part being fixed and the other moveable, as hereafter described. 2, In the employment of a trough extending round the furnace in the thickness of the wall thereof, for containing water, air, or other cooling agent, as hereafter described, in order to prevent any adhesion of the parts at the points of junction. 3, In the employment of sight holes in the lower part of the bushes and side of the crucible, whereby the state of wear of those parts may be viewed, in order to ascertain when they should be removed. The upper or fixed portion of the furnace, including the upper portion of the bushes and upwards, is built of fire brick, and rests on metal blocks extending round the furnace; the upper flange of a double flanged plate rests on the top metal blocks just named, while the lower flange supports the metal, water, or air trough. This trough forms the lowest part of the fixed portion of the furnace. Apertures are formed through the lining, and the double flanged plate before mentioned and walls of the furnace for the reception of bars of metal, which may be hollow or solid, and which are inserted through these apertures, and meet in the centre, for supporting the contents of the upper part of the furnace when the lower portion is removed. The lower and moveable portion of the furnace, from the lower part of the bushes downwards, is encased in a metal jacket, and is supported at bottom on a short metal platform with flanged edges, and this platform is supported upon axles carrying flanged wheels, which are made to run on rails below when a shift is required. Sight holes, before named, and tuyers are formed in the thickness of the walls of the lower portion of the furnace. A conical space is left all round between the water trough and the top of the moveable portion, and this is filled with refractory sand. To remove the moveable from the fixed portion of the furnace, when wear in the lower parts renders this desirable, bars are inserted through the apertures, before named, for the purpose of supporting the contents of the upper part of the furnace; and prior to their insertion the temperature should be reduced at the point of insertion, which may be effected by the injection of cold air or water. This done, all the furnace below the trough is lowered until the wheels rests on the rails; it is then run away, and a second and similar portion of a furnace, ready charged and heated, is rolled in to take its place; it is raised into the place of that removed, the bars are withdrawn, and the working proceeds as before. *Patent completed.*

1918. C. **Lungley.** *Improvements in constructing, building, and working floating docks and other floating bodies, and in pumping apparatus to be employed therein.* Dated July 1, 1862.

This invention will be described and illustrated in a future Number of this journal. *Patent completed.*

1919. G. H. **Birkbeck.** *Improvements in processes for the utilization of certain refuse products resulting from the manufacture of iron, such processes being applicable to the treatment of other metallic or mineral substances.* (A communication). Dated July 1, 1862.

The refuse material which it is proposed to treat and utilize according to this invention, consist of the slag and "scoriœ" obtained from the puddling or other furnaces employed for manufacturing or refining iron, and in reheating (or melting), the heads, "gyts" and waste top pieces of cylinders or other castings, the waste metal worked from "squeezers," "shinglers," pressed, or from other operations employed in the manufacture of iron, together with the treatment of waste or refuse metal generally, wherein a large proportion of valuable iron is contained, varying in most cases from 40 to 70 per cent. This richness is increased by a great quantity of metallic globules contained in the mass of these materials. The means employed according to this invention, for utilizing the whole of these materials, are exceedingly simple and inexpensive, and consist of two operations: first, In pulverizing them by means of edge runners, stampers, or other mechanical means; and, secondly, In their carburation previous to their introduction into the blast furnaces; this process being effected without additional cost of fuel. *Patent completed.*

1920. J. and G. **Greenhalgh.** *An improved diminishing valve, and also a water or steam escape apparatus to give alarm in case of fire, and to assist in quenching the same.* Dated July 1, 1862.

This invention consists, 1, In an improved diminishing valve. The patentees form the valve with the pistons, and make in one a number of inclined slots. The valve works in a pipe or cylinder forming part of the valve box or chamber connected to the steam or water pipe, and on the top of the valve there is a spring which is adjusted to any desired pressure by a screw. When the steam or water is admitted, it presses against the piston on which the spring acts, and brings the other piston nearer the passage, so that the inclined slots shall give more or less opening, according to the pressure. Or they make the valve with three pistons, and make inclined slots in two of them, and weigh the valve by a lever and weight. This invention consists, 2, In an improved self-acting fire alarm, and water or steam escape. The patentees suspend a weight by a band of gutta percha, cord, or other material, that can be consumed by fire, over a lever and catch in connection with a valve on a pipe containing water or steam, so that, when the band is consumed, the weight shall fall on the lever, and allow the valve to be opened for the steam or water to escape, and thus quench the fire. *Patent completed.*

1921. T. **Fellowes** and H. **Hemfrey.** *Improvements in apparatus for elevating straw and other agricultural produce.* Dated July 1, 1862.

For the purposes of this invention an endless rope, chain, or band, is employed, to which several apparatus are applied, each of which collects a quantity of straw or other agricultural produce; and having collected such quantity, the parts of the apparatus are arranged to close towards each other, and to retain the collected quantity securely till the apparatus has been raised by the movement of the endless rope, chain, or band, to the highest position, where the parts of the apparatus are caused to relax their hold of the straw or other produce, and allow it to drop on to a stack or other surface whereon it is desired to deposit such straw or other produce. The endless rope, chain, or band, is carried by two pulleys or wheels kept at the desired distance apart, in order that one pulley may be in the position where the straw is supplied from a thrashing machine, or otherwise, and the other pulley held in a position above the stack or other surface on to which the straw or other produce is to be deposited when it has been raised. *Patent abandoned.*

1922. J. M. **Dunlop.** *Improvements in cotton gins.* Dated July 1, 1862.

The cotton gin, known as Macarthy's, consists of a roller with leather lapped round it in a spiral direction, and having a metal blade or doctor pressed up against it. With these are combined a feed table, on which the seed cotton lies, and from which it is taken by the workman who applies it to the roller, so that it may become nipped between it and the doctor. There is also a vibrating blade or beater plate, the edge of which passes rapidly to and fro in front of, and close up to, the lines of nip between the roller and the doctor, and which serves to knock the seed out of the seed cotton there nipped and held; the seed falls off, and the fibre passes round with the roller, and is removed at the back. The patentee has found that cotton gins of this description are improved by the addition of another roller and doctor; the second roller is placed parallel to the first, and close to it. The rollers revolve in opposite directions, and away from each other at the front. They have a single beater plate between them, one edge of which serves to beat for one roller and the other for the other. The length of the beater arms is made adjustable, as is usual, to set it up to one of the rollers, and the bearings of the additional roller are so arranged that they can be set up by screws, or otherwise, to adjust it to the beater blade; after this has been set to, the first roller, or the bearings of each roller, may be made adjustable, and then no adjustment is requisite in the arms which carry the beater plate. In place of making the rollers revolve away from each other at the front, they may be made to revolve towards each other, and have one doctor between the two. In this case two beater plates are employed, but they are carried and actuated by the same arms and parts. *Patent completed.*

1923. W. E. **Newton.** *Improved machinery for washing wool.* (A communication). Dated July 1, 1862.

In carrying out this invention, an oval wash-tub is used, and is provided with a longitudinal central partition which does not reach either end of the tub. A rotary paddle is also adapted to a horizontal shaft for stirring the wool and cleaning it by dashing it about in the water. An endless apron made of wooden slots secured to bands is mounted between two segmental frames, having teeth on their edges, which gear into pinions so that the frame and endless cloth may be raised and lowered as desired. When the wool has been washed sufficiently, the endless cloth is lowered and raises the wool out of the water, and delivers it to a pair of squeezing rollers, which squeeze out the water and then deposits the wool on an endless travelling apron, whereby it is conveyed out of the machine. *Patent completed.*

1924. E. De Lebastida. *A new method of manufacturing india-rubber articles by the combinations of pressure and vulcanization.* (A communication.) Dated July 2, 1862.

In carrying out this invention the patentee constructs press plates of cast or wrought iron of considerable length, say from 10 to 30 ft., and from 1 to 100 ft. wide, and these plates are heated by steam, having chambers attached or partly formed by them, into which steam can be admitted. He so arranges these plates that the bottom is by preference a fixture or immovable table, and the top is made to rise and fall by means of screw, hydrostatic pressure, or any other convenient means. When he is about to make long pipes or tubes, he forms them in the usual way from solid sulphur composed of india-rubber, or of such compound of india-rubber and strong woven fabric, and he prepares a mould to receive it, and then places the mould with the tube in it upon the press table, and brings the top down with pressure enough to perfectly close the mould; in this way such length of the pipe or tube is subjected to heat, and vulcanized by means of the steam-heated press plates; and so soon as this is accomplished (which will be known by an experienced workman, after a trial or two). He then raises the top plate and opens the mould, and introduces another part of the same tube or pipe into the mould, and proceeds as before to vulcanize it, and thus he goes on piece by piece of one length of pipe. And, in order to make greater lengths than have hitherto been made, he leaves a piece of the ends of the tube or pipe out of the mould and unvulcanized, to one end of which he attaches or joins in a form and substantial manner the unvulcanized end of another piece which has been all vulcanized but the ends, and he then puts the joined, unvulcanized part, into a short mould suitable for the purpose, and submits the same to vulcanization. It will thus be seen that, by first vulcanizing all but a short piece of the two ends of, say 100 pieces of pipe or tubing, each 100 ft. long, and then uniting the ends of each as before described and vulcanizing them, he makes one perfectly vulcanized and unbroken tube of 10,000 ft. long by the combination of the large press and the small press, together with the process of joining in the manufacture of pipes and tubes. *Patent completed.*

1925. W. Porter. *Improvements in the manufacture of targets.* Dated July 2, 1862.

This invention consists in the construction of targets with two faces for gun, pistol, or rifle practice, whereby the "bull's eye" in one face of the target is set or brought into position when the other is struck, the improvements being particularly applicable to miniature targets, suitable for indoor snap cap practice and aiming drill. The miniature target, when placed at certain distances, represents in appearance the full size or regulation target, as it appears in reality at long distances from the person aiming thereat. *Patent abandoned.*

1926. J. James. *An improved mode of welding railway crossings.* Dated July 2, 1862.

The object of this invention is to make a more sound and secure welding of this important portion of a railway at a less cost than the mode in present practice. The invention consists in heating the rails or plates in a reverbatory or other furnace or fire, in placing them in moulds according to the sections of the rails or plates, which moulds are used as ordinary top and button tools, and in welding them under a Nasmyth's steam hammer, or other like suitable hammer, or otherwise welding them in a press or squeezer. *Patent completed.*

1927. J. Ellerbeck. *Improvements in looms for weaving.* Dated July 2, 1862.

In order to vary the force of the blow given to the picking motion, according to the width of the loom or other purpose required, the inventor employs the under picking stick, and places upon its cap a wide picking cam with a slot in it, and connects the cam to one arm of an L lever, working on a stand fixed to the loom side, having a nib on its other arm acted upon by a tappet on the tappet shaft. The slot in the cam on the picking stick cap is for the purpose of changing the position of its connection with the arm of the L lever, bringing the position nearer or farther from the centre of motion, thereby lessenning or increasing its traverse, and, consequently, lessening or increasing the force of the pick. *Patent abandoned.*

1928. B. Johnson. *Improvements in rope wheels for mines, collieries, and other similar purposes.* Dated July 2, 1862,

The object of thisinvention is to afford the means of a ready adjustment of the length of the winding rope between the rope wheel and the cage or article to which it is attached. On the shaft of the rope wheel the inventor fixes a boss in two parts, and having a flange on the outside, so as to form between them a circular groove, into which is fitted the rope wheel in such manner that it may be turned upon the boss when required, and afterwards bolted to the side flanges by bolts. In the side flanges he drills, in a circle of a given diameter, a number of holes, and in the solid part of the rope wheel around the boss he drills. in a circle of the same diameter, one, two, three, or more holes; more than there are in the side flanges, so that the bolts employed for holding the wheel and boss together can be passed into different holes, and thereby obtain a very delicate adjustment of the length of the rope. Thus, when there is one hole more in the rope wheel than in the flanges, if two bolts have been passed through two sets of holes opposite each other, and then withdrawn, so that the rope wheel can be turned to allow them to be passed through the next set of holes, the winding rope will be shortened a distance proportionate to a fractional part only of the circumferential distance between the holes, and if the rope wheel be turned to the next following set of holes, another fractional part will be added, and so on, the different numbers of the holes producing an effect similar to the use of the verner in philosophical instruments. When the boss consists of one part only, the rope wheel is to be formed of two parts, in order to place it between the flanges; or the plan may be varied by having the wheel of one piece and one of the flanges moveable. *Patent abandoned.*

1929. T. L. Atkinson. *Improvements in the construction of stew pans and other such like cooking utensils.* Dated July 2, 1862.

This invention consists in forming the boiler or stew-pan with an inner lining, within which are placed the articles to be cooked. The space between the inner lining and the outer holds the water which is introduced through the hollow handle, this being closed by a plug; the steam from the water enters into the interior through one or more holes formed in the upper part of the inner lining by means of the steam thus introduced. *Patent completed.*

1930. G. H. Hulskamp. *Improvements in violins and other similar stringed instruments, and in guitars.* Dated Jully 2, 862.

This invention is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Nov. 21, 1862.

3133. C. Wagner, Liverpool. Improvements in strengthening, securing, and rendering more durable the soles or bottoms of boots, shoes, and other coverings for the feet. (A communication.)

Dated Nov. 26, 1862.

3174. J. R. Danks, B. P. Walker, and R. P. Walker, Wolverhampton, manufacturers. Improvements in machinery or apparatus for making boot and shoe heel and toe tips, clog irons, and other similar articles.

Dated Nov. 27, 1862.

3181. D. and D. Auld, Glasgow, engineers. Improvements in working furnaces and steam boilers, and in apparatus connected therewith.

Dated Dec. 8, 1862.

3292. E. T. Hughes, 123, Chancery-lane. Improvements in galvanic apparatus. (A communication.)

Dated Dec. 16, 1862.

3358. J. J. Lemon, 10, New Compton-street, Soho, fancy wood and ivory turner. Improvements in book trays or holders.

Dated Dec. 19, 1862.

3399. D. Davidson, Woodcroft, Morningside, near Edinburgh. Improvements in the construction of telescopes, and in the method of arranging and fixing the same in combination with firearms for the purpose of adjusting the aim thereof.

3401. J. Dalton, Brooklyn, United States. Improvements in knitting machinery.

Dated Dec. 26, 1862.

3455. J. Swainson, Newton Stewart, Wigton, wood agent. Improvements in the manufacture of pill boxes and similar boxes from solid wood, and in machinery to be employed in the said manufacture.

Dated Dec. 29, 1862.

3464. A. W. Sleigh, knight, 16, Rue de Chateaubriand, Champs Elysees, Paris. An improved method of rendering or making ships and vessels and floating and shore batteries, or ambulent or stationary defences, impenetrable to shot and shell, and to other missiles and projectiles and war rams.

Dated Dec. 31, 1862.

3481. B. Bottomley, Rochdale, cotton spinner. Improvements in machinery for twisting and doubling yarns or threads of cotton and other fibrous materials.

3485. J. W. P. Field, 233, High Holborn, gun maker. Improvements in breech-loading firearms.

3487. J. M. Napier, York-road, Lambeth. Improvements in heating apparatus.

Dated Jan. 1, 1863.

1. R. H. Collyer, Beta House, 8, Alpha-road, Regent's-park. Improvements in the method of, and apparatus for, preparing materials for the manufacture of paper and similar purposes, part of the invention being also applicable to other operations in which materials are subjected to the action of hot agents.

3. G. Allcroft, New Church-row, Camberwell. Improvements in pressure gauges and vacuum gauges.

5. J. T. Smith, Lee, Kent, gentleman. Improvements in obtaining motive power from steam and the products of combustion.

7. J. J. Southgate, Kensington, builder. Improved arrangements for portable fire escapes.

9. W. Soutter, coppersmith, Birmingham. Certain apparatus for raising and planishing metals.

11. J. E. Baker, Cheapside, and J. Landon, Crosskey-square, Little Britain, boot makers. Improvements in the construction of boots, shoes, and other coverings for the feet.

Dated Jan. 2, 1863.

13. F. C. Bakewell, 6, Haverstock-terrace, Hampstead. Improvements in apparatus for burning oils and other inflammable fluids as fuel. (A communication.)

15. H. Lyon, 31, Sydney-street, Commercial-road, cigar manufacturer. Improvements in the finish and mode of packing cigars, and in apparatus used for these purposes.

17. E. T. Hughes, 123, Chancery-lane. Improvements in producing designs upon velvets, cloth, furniture hangings, and similar materials. (A communication.)

19. H. J. Sergeant, Manchester, silk finisher. Certain improvements in the method of dressing and finishing silk fabrics, and fabrics composed of silk, cotton, and wool.

Dated Jan. 3, 1863.

23. H. Jones, Manchester, engineer. Certain improvements in steam engines.

25. W. Phillippi, iron works, Stromberg, Prussia. Improvements in the manufacture of bearings and axles boxes for machinery, carriages, and railway rolling stock.

27. W. Astrop, Jubilee-street, Stepney, stationer. Improvements in the manufacture of paper.

28. C. B. Clough, Lewyn Offa, Mold, Flint, esquire. Improvements in apparatus for curing smoky chimneys.

29. W. T. Smallware, manufacturer, Fazeley, Stafford, and C. B. Weaver, Fazeley. Certain improvements in treating or covering strip steel, or other sitnable material, for the making of crinoline skirts and other similar purposes for which the same may be applicable, and which same treatment or covering may be used for trimming or strengthening certain parts of ladies' dresses.

Dated Jan. 5, 1863.

31. E. B. Keeling, Gray's-inn, architect. An improvement in lighting halls, theatres, and other buildings.

33. J. A. Cooper, Trowbridge, gentleman. The application of a fibre obtained from a certain plant as a substitute or to be used with silk, cotton, flax, and such like materials, which fibre has not hitherto been applied to any of those purposes, and for certain methods of preparing the same for such purposes.

35. H. Blacktin, Bradford, York, saw maker and ironmonger. Improvements in means or apparatus for saving or preserving money, papers, or other valuable property at sea in case of shipwreck. (A communication.)

37. H. Bessemer, Queen-street-place. Improvements in the construction and mode of working apparatus to be employed in pressing, moulding, shaping, embossing, crushing, shearing, and cutting metallic and other substances.

39. D. Nevin and W. Coppin, Londonderry. Improvements in machinery for clearing and separating the woody parts from the fibrous portion of flax, hemp, or other like material.

Dated Jan. 6, 1863.

40. J. A. Munn and J. D. Cobb, 8, Gresham-street, merchants. Improvements in automatic walking dolls and other figures. (A communication.)

41. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in magneto-electric telegraphs. (A communication.)

44. J. Leigh, Manchester, gentleman. Improvements in the treatment of gas produced by the distillation of coal, cannel, bituminous shale, boghead, mineral oils, petroleum, or other combustible substances, and for the obtaining of certain products therefrom.

45. T. and T. Vicars, and T. Ashmore, Steel-street, Liverpool, engineers. Improvements in machinery for manufacturing bread, biscuits, and other like articles.

46. J. A. Knight, 4, Symond's-inn, Chancery-lane, American law agent. Improvements in printing presses. (A communication.)

47. M. Hodgart, Paisley, engineer. Improvements in presses for pressing cotton and other substances. (A communication.)

49. J. G. Dahlke, Battersea. Improvements in machinery for cutting clay in the manufacture of bricks, tiles, and similar articles. (A communication.)

50. G. Turner, shoe manufacturer, Campbell-square, Northampton. A new method of making leather from waste pieces of common leather.

51. J. Whitworth and W. W. Hulse, Manchester, engineers. Improvements in ordnance.

Dated Jan. 7, 1863.

53. J. Neale, 11, King's-road, Ballspond, gentleman. Improvements in the manufacture of capsules. (A communication.)

54. T. F. Cashin, Sheffield, civil engineer. Improvements in covering wire, crinoline steel, or hoops or skirts.

55. W. Crabtree, Newton Green, near Todmorden, manufacturer, and J. Crowther, weaver. An improved mode of perching and dressing textile fabrics during the process of weaving.

56. W. S. Bruce, Great St. Helen's. Improvements in lucifer matches, fusees, and other similar lights, and in the boxes or holders for containing the same. (A cammunication.)

59. G. C. Grimes, 8, Wandle-terrace, South-street, Wandsworth. Improvements in means or apparatus for treating splints used in the manufacture of matches and other lights.

63. G. T. Bousfield, Loughborough-park, Brixton. Improvements in skate fasteners. (A communication.)

64. H. Harben, Oxford-villa, Haverstock-hill, gentleman. Improvements in the manufacture of fibrous material for cleansing machinery and other purposes.

65. J. H. Johnson, 47, Lincoln's Inn-fields, gentleman. Improvements in the permanent way of railways. (A communication.)

Dated Jan. 8, 1863.

70. R. T. Monteith, St. Malo, France, British Vice-Consul, and R. Monteith, 64, Crystal-terrace, Greenheys, Manchester, gentleman. Improvements in the manufacture of dyes from aniline and its analogues. (A communication.)

Dated Jan. 9, 1863.

74. R. Thomas, 70, Berners-street, Oxford-street. Improvements in apparatus for rendering hair wavy.

78. D. B. Parsons, 77, Upper Thames-street. Improvements in reaping and mowing machines. (Partly a communication.)

80. D. Collinge, Oldham, cotton spinner and manufacturer. Improvements in machinery or apparatus for cleaning and preparing cotton or other fibrous materials to be spun.

82. G. B. Price, Bedford, engineer. Improvements in sights for firearms.

84. M. Henry, 84, Fleet-street. Improvements in furnaces. (A communication.)

Dated Jan. 10, 1863.

86. W. Grove, Tenbury. Improvements in apparatus for sawing wood and other substances.

88. M. Vogl, Sambrook-court, Basinghall-street, merchant. An improved fastening for bags and other articles.

Dated Jan. 12, 1863.

92. D. Dawson, Milnsbridge Chemical Works, Huddersfield. Improvements in manufacturing "magenta" colour or dye.

94. E, Stevens, 139, Cheapside. Improvements in ovens, hot plates, and cooking apparatus.

96. W. Clark, 53, Chancery-lane, engineer. Improvements in carding engines. (A communication.)

Dated Jan. 13, 1863.

100. T. G. Lewis, Cumberland-place, Newington-butts, perambulator maker. Improvements in apparatus applied to perambulators, invalid chairs, and other carriages.

104. W. Platts, Manchester, merchant, and J. Bailey, cotton dealer. Certain improvements in telegraphic cables.

106. C. H. Townsend and J. Young, Bristol, engineers. Improved compositions for preventing incrustation and corrosion in steam boilers and condensers.

110. C. E. Amos, Grove, Southwark, engineer. Improvements in machinery for the manufacture of paper.

112. T. Butler, manager, Nottingham. Improvements in the manufacture of lace in twist lace machines.

114. H. Bessemer, Queen-street-place, Cannon-street. Improvements in the manufacture and treatment of malleable iron and steel, and in furnaces, machinery, and apparatus employed in such manufacture.

Dated Jan. 14, 1863.

118. J. S. Butler, St. Alban's-terrace, Nottingham, lace manufacturer. Improvements in the manufacture of bobbin net made on bobbin net or twist lace machines.

120. G. A. Biddell, Ipswich, mechanical engineer. Improvements in machines for pulping turnips and other vegetable substances.

122. J. Lawson, Hope Foundry, Leeds. Improvements in apparatus for holding castings and other pieces whilst being planed or shaped.

124. G. Holt, 5, Canterbury-place, Lambeth-road. Improvements in apparatus for sweeping or cleaning chimneys, and also in apparatus for preventing chimneys from smoking.

Dated Jan. 15, 1863.

128. W. Hulse and C. L. Haines, Birmingham, metallic bedstead manufacterer. Improvements in machinery for the manufacture of taper metallic tubes.

130. T. C. Barraclough, Manchester, engineer. Improvements in apparatus for cutting metallic tubes or pipes, or tubes or pipes composed of other indurate substances. (A communication.)

136. C. Murrell, Pinfold-street, Aylsham, Norfolk, joiner. Improvements in breech-loading firearms.

140. A. Prince, 4, Trafalgar-square, Charing-cross. Improvements in sewing machines.

INVENTIONS PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF A COMPLETE SPECIFICATION.

Dated Jan. 14, 1863.

119. G. T. Bousfield, Loughborough-park, Brixton. Improvements in machinery for rolling, grinding, and cutting files. (A communication.)

Dated Jan. 17, 1863.

155. G. T. Bousfield, Loughborough-park, Brixton. Improvements in hot-air engines. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, Tuesday 27.

2534. H. M. Radloff. Filtering oils.

2540. G. L. Lee. Metallic shutters, doors, and windows.

2547. L. Leigh. Stretching and glossing fibrous materials.

2549. R. Cranston. Washing machine.

2553. J. Douglas. Fire ranges.

2555. J. H. Johnson. Gas burners. (A communication.)

2560. W. H. Browne and H. Armstrong. Gas meters.

2570. D. C. Bridge and J. Dyson. Warming buildings and similar purposes.

2574. J. Imray. Telegraphing. (A communication.)

2575. R. R. Jackson and J. Coupe. Looms.

2577. G. Maw. Tesseræ and other mosaic inlays.

2583. J. Wilson. Boilers.

2584. A. Prince. Furnaces. (A communication.)

2590. M. Vogl. Fastening articles of wearing apparel.

2605. W. Maddick. Treating and preparing madder.

2607. R. R. Jackson and Æ. I. Jackson. Treatment of flax and other fibrous materials.

2608. R. R. Jackson and Æ. I. Jackson. Cutting fibrous materials.

2613. T. Kennedy. Taps or valves.

2614. F. Tolhausen. Steam cultivator. (A communication.)

2615. J. Raywood. Gas apparatus.

2616. J. R. Breach and E. B. P. Smith. Reducing or equalizing the length of animal or vegetable fibres.

2617. J. Eardley. Pitch or tuning pipes.

2626. E. Dixon. The manufacture of welded iron tubes.

2634. M. Henry. Improved applications of petroleum and its products. (A communication.)

2661. W. C. Cambridge. Washing clothes.

2672. W. Clark. Atmospheric toy pistols and guns. (A communication.)

2673. W. Clark. Candlestick. (A communication.)

2720. M. A. F. Mennons. Self-inking hand stamps. (A communication.)

2729. J. B. Palser. Manufacturing of paper pulp.

2735. J. Lowe and J. Harris. Propeller.

2824. J. B. Payne. Fibrous substances.

3101. R. Beck. Reading glasses and magnifyers.

3117. G. W. Oldham. Preparing fibrous substances.

3123. J. W. Hjerpe, W. Holmgren, and A. V. Sundstedt. Composition or preparation of materials applicable for igniting matches.

3388. J. and A. Brierley. Carding engines.

3428. J. Whitley and J. W. Burton. Permanent way.

3476. W. Mould. Plaiting or folding and measuring fabrics.

19. H. J. Sergeant. Dressing and finishing silk fabrics.

41. W. E. Newton. Magneto-electric telegraph. (A communication.)

67. L. Hull. Treatment of ground caoutchouc.

130. T. C. Barraclough. Cutting metallic tubes or pipes. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Jan. 21, 1863.

2083. R. Grogan.
2099. R. Bell.
2100. J. Leetch and B. Mathew.
2103. W. Clissold.
2106. J. G. Clarke.
2107. W. H. Perkin.
2110. H. A. Jowett.
2111. J. and H. Redgate.
2112. J. Anderson.
2113. P. Robertson.
2114. W. Clark.
2124. J. H. Selwyn.
2127. J. Walton and J. Moore.
2128. H. Bollinger.
2135. T. Cook.
2136. A. Noble.
2160. B. Bailey.
2223. N. J. Amies.
2239. W. E. Newton.
2243. N. J. Amies.
2278. J. H. Johnson.
2286. G. White, F. Buckland, and C. Rees.
2349. D. Moore.
2351. D. Moore.
2358. M. Henry.
2382. A. V. Newton.
2756. C. Thomas.
2928. G. Mayall and J. Hollingworth.
3160. E. Wadsworth.
3198. W. E. Gedge.

Sealed Jan. 23, 1863.

2130. W. Spence.
2132. W. Spence.
2133. T. A. Favrichon.
2134. W. Maugham.
2137. J. Fourdrinier.
2139. F. Selby.
2140. H. Hedgely.
2141. E. Burnett.
2148. E. T. Hughes.
2150. J. Norris.
2151. C. T. Burgess.
2164. G. H. Birkbeck.
2170. E. F. Prentiss and A. Robertson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

155. J. F. Belleville.
158. O. Vivier.
185. F. Yates.
190. F. G. Grice.
221. T. Dunn.
227. W. H. Tooth.
153. C. P. P. Laurens.
201. P. Effertz.
280. A. Watkins.
165. M. Rae.
172. C. C. J. Guffroy.
209. F. Walton.
166. J. Potter.
257. W. Hartley.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

163. J. B. P. A. Thierry, jun., J. L. Richard, and B. H. de Martiny.
171. J. Francis.
313. J. Howard.
218. W. Beasley.
197. F. Chauchard.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending January 30, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
1780	0 4	1792	0 4	1804	0 4	1816	0 10	1827	1 0	1838	0 4
1781	0 4	1793	0 4	1805	0 10	1817	0 4	1828	0 10	1839	0 8
1782	0 10	1794	1 2	1806	0 6	1818	1 0	1829	0 4	1840	1 0
1783	0 4	1795	0 8	1807	0 4	1819	0 4	1830	1 0	1841	0 6
1784	0 4	1796	0 4	1808	0 4	1820	1 4	1831	1 4	1842	0 8
1785	0 10	1797	0 4	1809	0 4	1821	0 4	1832	1 4	1843	0 4
1786	0 6	1798	1 2	1810	0 8	1822	0 10	1833	0 6	1844	0 8
1787	0 4	1799	1 10	1811	0 4	1823	0 4	1834	0 10	1845	1 6
1788	0 4	1800	0 4	1112	0 4	1824	0 4	1835	0 4	1846	0 10
1789	1 4	1801	0 8	1813	0 4	1825	0 4	1836	1 4	1847	0 4
1790	0 10	1802	0 4	1814	0 4	1826	0 4	1837	0 10	1848	0 8
1791	0 4	1803	0 4	1815	0 4						

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Timber, duty 1s. per load, drawback, 1s.

	£	s.	£	s.
Teak ......load	14	0	15	0
Quebec, red pine	3	10	4	10
,, yellow pine	3	0	4	0
St. John, N.B., yellow	5	0	5	10
Quebec oak, white	5	10	6	10
,, birch	3	0	3	10
,, elm	3	10	5	0
Dantzic, oak	3	10	6	10
,, fir	2	10	3	10
Memel, fir	3	0	3	5
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzig, fm.	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	19	10
St. John, white spruce	14	10	16	10
Yellow pine, per reduced C.				
Canada, 1st quality	17	0	18	0
,, 2nd do	11	0	12	0
Archangel, yellow	13	0	13	10
St. Petersburg, yellow	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white	9	0	9	10
Gefle, yellow	10	0	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.				
,, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
Pumice Stone, per ton	5	10	9	0

OILS, &c.

	£	s.	£	s.
Seal, pale ......per tun	48	0	0	0
Sperm body	86	0	87	10
Cod	47	10	0	0
Whale, South Sea, pale	41	10	0	0
Olive, Gallipoli	60	0	0	0
Cocoanut, Cochin	57	10	0	0
Palm, fine	39	10	40	5
Linseed	43	15	0	0
Rapeseed, English pale	53	10	54	0
Cottonseed	33	10	43	10

METALS.

		£	s.	d.		£	s.	d.	p.ct.
Iron:									
Welsh Bars, in London	per ton	6	10	0	to	7	0	0	2½
Nail Rods	,,	7	10	0	,,	7	15	0	,,
Hoops	,,	8	10	0	,,	9	0	0	,,
Sheets, single	,,	9	5	0	,,	9	10	0	,,
Staffordshire Bars	,,	7	15	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	6	0	0	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	15	0	,,	2	18	0	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
Steel:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	10	0	,,	18	0	0	,,
Copper:									
Sheet and Sheathing, and Bolts	,,	105	0	0	,,	0	0	0	3
Hammered Bottoms	,,	115	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	110	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	98	0	0	,,	0	0	0	,,
Tile Copper	,,	98	0	0	,,	0	0	0	,,
Best Selected	,,	101	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	11	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	9½	,,	0	0	0	3to7½
Fine Foreign	per ton	98	10	0	,,	0	99	0	3
Tin:									
English Block	pr cwt.	115	0	0	,,	0	0	0	2½
Bar	,,	116	0	0	,,	0	0	0	,,
Refined	,,	120	0	0	,,	0	0	0	,,
Banca	,,	122	0	0	,,	121	0	0	nett
Straits	,,	120	0	0	,,	121	0	0	,,
Tin plates:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
Lead:									
Pig, English	per ton	21	10	0	,,	22	0	0	2½
Spanish, Soft	,,	20	10	0	,,	0	0	0	,,
Shot, Patent	,,	23	10	0	,,	0	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	27	10	0	,,
Spelter:									
On the spot	,,	18	5	0	,,	18	7	6	nett
Zinc:									
English Sheet	,,	23	5	0	,,	23	10	0	2½
Quicksilver	pr btl.	7	0	0	,,	0	0	0	3
Regulus of Antimony:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, FEBRUARY 6, 1863.

THE ADMIRALTY POLICY IN NAVAL CONSTRUCTION.

Together with the announcement of the appointment of a new Chief Constructor of the Navy, and of further prospective changes in the constitution of the Comptroller's Department at Whitehall, we have the gratifying news that there will be a very considerable reduction in the Naval vote for next year.

It is apparently the intention of the Admiralty to enter honestly upon the path of reform, and we take these changes as the earnest of a better state of things.

It is, we believe, to Admiral Robinson, the Comptroller of the Navy, that very much of the credit of this is due. As a member of the Royal Commission for enquiring into the control and management of Her Majesty's Dockyards, he became thoroughly acquainted with the defective organization of the Department of the Comptroller, by which it failed to assert its independence of the Board of Admiralty in scientific matters on the one hand, and to exercise proper control over the practical operations of the dockyards, on the other.

When, upon the retirement of Sir Baldwin Walker, Admiral Robinson was appointed Comptroller of the Navy, he had the good fortune to find in the Duke of Somerset a man fully alive to the importance of the interests entrusted to him, and prepared to take any measures which his subordinate considered likely to result in the good of the service.

The most important step yet taken in this respect is that of the appointment of Mr. Reed, and we shall await with considerable anxiety the alterations which the Comptroller and his new professional adviser will make at Whitehall and in the Dockyards. In the meantime we should like to point out what has always appeared to us to be a vital error in the policy of successive administrations in naval construction. It has been the passionate desire of the English people, and the professed aim of its statesmen and official servants, to make the British Navy the most powerful in the world. We have believed it necessary to our existence that this should be so, and have never grudged any amount of money necessary for accomplishing it.

One would suppose that in order to maintain such a position it would be desirable to introduce the most efficient machinery of war which the progress of knowledge rendered available. We should have taken it as certain that the English people would never be content to use, generation after generation, the same antiquated and cumbrous machinery, allowing the courage of the seamen, and the mere number of the ships and engines of war to atone for its mechanical deficiencies.

Yet this has really been the case. No one can dispute the fact, that it has been to the courage and conduct of her seamen, and the spirit and skill of their leaders, that England has owed her naval supremacy. It has not been, notwithstanding her mechanical advantages, to superiority in ships, artillery, or any of the machinery of war. No pains have been spared, we admit, to improve the appearance, and increase the accommodation of our ships of war, so that an English line-of-battle ship has become almost perfect both with regard to outward form, and internal arrangement. But no changes whatever, of greater moment, have been *initiated* in the English Navy.

The argument of our administrators has been, "Give to our seamen as good a ship as their enemy, and there need be no fear of the issue. Any attempt on our part to improve the means of attack or defence, will certainly be followed by our adversaries, and after all the expense has been incurred, the odds will be the same as before."

But there is a fallacy here, which it behoves us, as pioneers and expounders of mechanical science, to bring prominently under the notice both of the gentlemen who now have the direction of these matters, and of the public by whom their actions will be judged.

A familiar illustration of the argument just recited is, that England is in the position of a manufacturer who has a large capital invested in his business, and occupies the foremost position in the trade. Any considerable changes in the material or mode of manufacture, renders old stock useless, or at least, greatly reduces its value. As this man has a larger stock in trade than his neighbours, he will suffer most by these changes, and it is, therefore, contrary to his interests to introduce them.

Now, this statement of the case would be quite true if the manufacturer in question had the power of preventing his rivals from making changes and improvements. But, if he have not this power, the irresistible progress of knowledge will give to a rival the *éclat* and profit of the new and improved goods, and he has to suffer a loss of position as well as the depreciation in the value of his stock.

If, on the contrary, he takes care to buy up useful patents, and to encourage invention, he will retain his *prestige*; and being constantly impressed with the necessity of avoiding the accumulation of inferior stock, he will not be likely to suffer by the changes which are in his own hands.

Thus, dropping the illustration, while we admit that the English sailor needs no better ships or better guns than his enemy—while we admit also that any improvements in these respects will be speedily followed by other nations, leaving the odds the same as before—we contend that it is, nevertheless, bad policy for a nation like England to be content to allow all important changes to originate with her rivals, and to receive from Paris or New York the latest novelties in marine architecture. The actual consequences of the adoption of this policy have been a succession of most demoralizing and costly panics, involving a great waste in the hasty construction of the ships supposed to be required, and in providing various kinds of unnecessary coast defences. Take, for example, the change from sails to steam. England is the cradle of the steam-engine; and its marvellous marine adjunct, the screw propeller, is an English creation. The powers of both engine and propeller were known and acknowledged by the Admiralty, certainly as early as 1845. The men and the material were then ready to produce a screw line-of-battle ship, which might have been built, had it not been for the credit given to the false principle we are attacking. Had this been done, there would have been some sensation at Paris and St. Petersburg, and similar ships would have been commenced in all probability by the great maritime powers. But none of these powers had any position to lose by this advance of England, and they might have been expected to make their changes leisurely, and as the finances of the State would admit.

England, on her part, need have made no undue haste to increase the number of these new creations. She would continue to employ her old ships, they being at least as good as those of her neighbours; but she would not have overstocked herself with them, nor would she build any more after their model. Every new ship required to replace an old one would be of the improved kind. It is not too much to say that the production by England of one such ship would have ensured the maintenance of her *prestige* for years, while the expenses of conversion and re-construction would have been avoided. But this was not done; and in 1850 France built the ship, which England should have built at least five years before. And although a similar ship was at once commenced in hot haste in England, the old machinery rolled on its accustomed course, so that it was not until 1859 that the House of Commons was asked to provide for the general introduction of steam into the navy.* But by this time the French Government had made another start ahead, and at the very moment when the House of Commons was voting extraordinary supplies for converting sailing line-of-battle ships into steam ships of the line, the two ships were quietly building at Toulon, which have brought about another revolution, and compelled us again to stop and re-construct.

It is true that, before the iron-cased "Gloire" and "Normandie" were launched, England had commenced her iron-cased ships; but she has continued to build and convert her uncased vessels for three years, and by extraordinary exertions has, in the end, succeeded in obtaining that screw steam fleet which was so ardently desired by our administrators in 1859. Having obtained it, we are informed by one authority that the man who goes into action in such ships is a fool, and the man who sends him there a villain.† And another‡ coolly informs us that we have no fleet except two ships—the "Warrior" and the "Black Prince." These are the plain consequences of being content with ships as good as those of our neighbours. Had we built the "Warrior" five years before, as we might have done, how different would have been our position. And the argument remains sound, notwithstanding that the assertions to which we have referred are so exaggerated as to be mere figures of speech.

To what precise extent the existence of the French iron-cased ships affects the value of the English unprotected fleet, is a very curious question.

Great damage is unquestionably due to England by the mere fact of their existence; and should there be a war between France and England, the credit of England would demand that in no part of her dominions should her unprotected ships be exposed alone to their attack.

The conclusion to which this leads is, that if England is to maintain her *prestige* as a naval power, and avoid costly and undignified panics, she must not be content with having more ships and better sailors than any of the other powers, but she must also be foremost in the creation of the machinery of war. She must not discourage thoughtful, practical men, who seek to improve our naval architecture and seamanship—she must no longer grudge the money spent in well-directed experiments; but she must consider that money well spent which saves her from such errors as those we have recorded.

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* In her Majesty's speech, at the opening of the Parliament of 1859, she said:—"The universal introduction of steam power into naval warfare will render necessary a temporary increase of expenditure in providing for the reconstruction of the British navy."

† Capt. Sir Jno. D. Hay. ‡ Mr. J. Scott Russell.

JAMES WATT AND PATENT LAW.

THE life of "the greatest inventor of all ages and nations" offers deep and instructive lessons on patent law; lessons unrivalled for vivid intensity and practical suggestiveness. Let it not be said that we look too far back for our instance, for mankind is still only on the threshold of the practical applications of science, and the appearance of another man such as Watt, might probably effect changes of almost equal magnitude to those inaugurated in his famous patent of 1769.* There is, besides, an advantage in taking for our example the history of an invention of old date. The actors being long since dead, the truth is known more completely, from the family documents having been published. The secret history of many more recent inventions would probably tell of similar experiences.

It has been asserted by the opponents of patent rights that "even if these rights were abolished, invention would not stop. Inventors are said to invent as hens lay eggs. The most valuable inventions are made by professionals striving to improve and advance the special business in which they are engaged." It has also been asserted, that many important inventions have sprung from an accidental source, and further, that if one man did not stumble upon any given combination, the next man would be more fortunate. Invention and progress are thus said to be only questions of time. This latter doctrine has found disciples in our own day, and in reference to Watt himself, Tredgold, in his work on the steam-engine (1827) asserts—"The *fortunate* (!) idea of condensing in a separate vessel, which in Watt's engine is the only essential part in saving of fuel, beyond what Smeaton had accomplished, *would, undoubtedly, in a short time, have occurred to some other person.*" No doubt very many inventions owe their origin to professionals, to fortunate accidents, and to mere time. It is, however, no less true that some of the greatest and most original discoveries have been brought forward by outsiders; by men whose mental vision had not been shortened by a lifelong concentration on the narrow horizon of a daily practice. Men engaged at a lifelong occupation have their ideas so warped to the shape of the things continually before their eyes, that it would be difficult to convince men so circumstanced as to the advantage of any new scheme, even if it could be adopted gratuitously. Besides, the interest of a manufacturer is generally directly opposed to the introduction of a new process, that may at last supersede his own machines and his existing plant. The cry of such a class is:—"Great is Diana of the Ephesians." The great philosophic poet of Germany, Goethe, says, "Every (new) idea appears as a strange guest; before being embodied a new idea can scarcely be distinguished from imagination and phantasy. We can perceive the usefulness of an idea, and yet not see how to put it to use."

As we said, the most original inventions owe their origin to outsiders. Take amongst many instances of this phenomenon, the case of James Watt, the mathematical instrument maker. In the excellent life of Watt, written by his relative, Mr. Muirhead, this gentleman quotes the following from Desaguiliers' "Course of Experimental Philosophy," written in 1763: "These discouragements stopped the progress and improvement of this engine (Captain Savery's) till Mr. Newcomen, an ironmonger, and John Cawley, a glazier, living at Dartmouth, brought it to the present form in which it is now used, and has been near these thirty years." (The first edition of Desaguilier's first volume was published in 1734; the first edition of the second volume, from the third edition of which the above passage is taken, was published in 1744.) *It thus appears that the steam-engine had to wait nearly seventy years for the magic hand of a Watt.* It is not generally known that in some of the outlying colliery districts of England, where slack coal is plentiful, and nearly worthless, some old engines of Newcomen are still extant, or, at any rate, were so within the last few years. Newcomen's engine shows very well what mere accident can do, as also what accident cannot effect. The packing of Newcomen's piston, effected in the same way as pump buckets are still packed, was discovered by accident. Its further packing, by means of a stratum of water, was probably due to chance. The use of this layer of water also led, notoriously by accident, to the method of condensation by injection. The self-acting gear was added by a boy. Smeaton now took up the steam, or rather the atmospheric engine, and improved it by properly arranging and proportioning the engine and boiler, leaving het general principle untouched. Smeaton was an excellent engineer, but he was not a very inventive man. The history of the steam-engine thus shows very well what chance can do for progress, and also what professional men, unaided by inventors, can effect in the same direction. It might be supposed that there was little or no demand at that time for steam power. The contrary, however, was the case; as many of the most valuable Cornish mines were being abandoned from the expense in fuel of the Newcomen atmospheric engine.

Another objection to patent-right has been raised because many inventions have been made simultaneously. It no doubt often happens that when a want for anything is public and well known, the same remedy may be proposed by several men. A certain question in science or art being once definitely put, no wonder that the answers coincide. The great difficulty, however, is to put the given question in a definite manner. In "*A Plain Story,*" written by Watt himself, for the information of counsel in the several lawsuits he had to go through, Watt states:—"The matter having got firm hold of his mind, and his circumstances obliging him to make exertions to regain what he had spent (in experiments) he turned the matter over in every shape, and laid it down as an axiom, *that to make a perfect steam-engine it was necessary that the cylinder should be always as hot as the steam which entered it, and that the steam should be cooled down* (afterwards) *below* 100 *deg., in order to exert its full powers.*" This axiom being once in the possession of several men, we can conceive that several would thereupon light upon the separate condenser.

Watt, who was accustomed to say—"Nature can be conquered, if we can find out her weak side," definitely put the question, and practically answered it by creating the steam-engine, to which no new principle had been added since Watt's death.

It is scarcely possible to believe that the steam-engine could have been so soon elaborated, or even brought out at all, without the existence of some patent law. Watt himself might have carried it out, if he had been provided with funds, but he never would have got men of business to aid him without the hope of some return for their pecuniary sacrifices. Watt had nearly ruined himself in experiments, before he met with a partner. In August, 1768, he thus wrote to Mr. Boulton:—"When you were so kind as to express a desire to be concerned in my fire-engine, I was sorry I could not immediately make you an offer. The case is this:—*By several unsuccessful projects and expensive experiments, I had involved myself in a considerable debt* before I had brought the theory of the steam-engine to its present state. About three years ago a gentleman, who was concerned with me, died. As I had at that time conceived a very clear idea of my present improvements, and had even made some trial of them, though not so satisfactory as has been done since, Dr. Roebuck agreed to *take my debts* upon him, and to lay out whatever more money was necessary, either for experiments or securing the invention; for which cause I made over to him *two-thirds* of the property of the invention. The debts and expenses are now about £1,200." To illustrate the necessity of an alliance of a monied partner with an inventor, which also implies the necessity of a patent law, we will quote the words of Dr. Robison:—"Watt's situation in life made it imprudent to engage in great expenses, and he was obliged to look out for an associate. Most fortunately there was in the neighbourhood such a person as he wished, Dr. Roebuck, a gentleman of very uncommon knowledge in all the branches of civil engineering, familiarly acquainted with the steam-engine, of which he employed several on his collieries, and deeply interested in this improvement. He was also well accustomed to great enterprises—of an undaunted spirit, not scared by difficulties—not a niggard of expense. *Such a man was indispensibly necessary to one of Watt's character—modest, timid, easily frightened by rubs and misgivings, and too apt to despond.*

Watt wrote, November, 1772, to Dr. Small—"I would rather face a loaded cannon than settle an account or make a bargain. In short, I find myself out of my sphere when I have anything to do with mankind; it is enough for an engineer to force Nature, and to bear the vexation of her getting the better of him. Give me a survey to make, and I think you will have credit of me; I can draw tolerably; set me to contrive a machine, and I will exert myself."

As a forcible instance of the value that is set by the multitude on an invention that is not ocularly, tangibly, and practically in full operation, we will further quote the following:—"None of his creditors (Dr. Roebuck's) value the engine at a farthing," wrote Watt to Dr. Small, July 25, 1773. It also appears that even Watt himself had but a low opinion of the pecuniary value of the invention. As everyone knows, Matthew Boulton, in 1773, took Watt into partnership,. After working together for two years, and six years of the patent of 1769 having thus expired, it became evident that in the then state of mechanical art, the remaining eight years of the patent would only suffice to make the engine practicable, without at the same time affording any return in the shape of profit.

Messrs. Boulton and Watt then determined to apply for an Act of Parliament to prolong the patent for 25 years. Watt wrote to his father, May, 1775—"The affair has been attended with great expense and anxiety, and without many friends of great interest, I should never have been able to carry it through; as many of the most powerful people in the House of Commons were opposed to it." Strange to say, the famous statesman and orator, Burke, opposed the measure.

As the importance of the invention was not yet generally recognised, the prolongation of the patent does not seem to have been opposed by those interested in using and manufacturing steam-engines. Watt wrote to Mr. T. Parker in 1797:—"One fact, however, I must inform you of is, that, prior to the Act of Parliament, we had sold no engines, though we had made some; they were merely to satisfy ourselves,—and had the act not passed the invention had fallen to the ground." Another crime of mediocrity on genius would thus have to be inscribed in the annals of humanity, and Watt's name narrowly missed being added to the long list of the "Martyrs of Science." The prolongation of the most momentous and valuable patent ever taken out, affords a very interesting and striking instance of the importance of prolonging patents. Boulton and Watt spent enormous sums on the steam-engine before getting any return. Mr. T. Webster was asked, before the Patent Law Committee of the House of Lords, in 1851:—"Are you not aware that Mr. Watt made no profit whatever by his original improvement of the steam-engine? Answer—None.

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* 1769 was the date in which Arkwright took out his first patent. This year, as is well known, also witnessed the birth of Napoleon I., Wellington, Mehemet Ali, Castlereagh, Humboldt, Cuvier, and M. I. Brunel, and of some other great men.

"Are you aware that, if his patent had not been extended for 28 years, he would have been rather injured than benefitted by his inventions? Answer—There is no doubt of it.

"The first 14 years yielded no benefit to him? Answer—That has been the case with many patents of that class." (Watt's original patent was sealed on the 5th January, 1769, and in May, 1775, he got it extended for 25 years; it therefore expired in 1800. The patent thus lasted more than 31 years, and *not* 28 years only.)

Mr Bennett Woodcroft, the distinguished patent commissioner, was asked before the same committee:—"Do you think that there ought to be any alteration in the law with regard to the duration of patents? Answer—I think they are too short—very much too short for me. I have here a list of the first 25 patents that were granted by James the First. The term of the first grants of patents was 12 years, and all the rest were 21 years, except some two or three for 31 years.

"Would you, as a general rule, grant the same term to all patents? Answer—*The difficulty is to decide which ought to have a long and which a short patent; some pay immediately, and some it takes years to mature, and it would be well if it could be decided.*" Probably the present state of the law is best, whereby a patent may be prolonged, on its being shown that no adequate profits have been derived during the 14 years of the patent. The law costs of a prolongation are, however, too high for a poor patentee. An American patent cannot be prolonged, but the duration of a patent in that country is 17 years. It is also evident that some distinction ought to be made between patents for crinoline and patents for steam-engines.

We now come to a very painful period of Watts's life—that period, namely, during which he encountered the pirates and infringers of his inventions. Watt was, for no less than seven years, engaged in these law suits. It is marvellous how the morality and honesty of some people are bounded by the range of their five senses; how men, who would scorn to appropriate things they can see, smell, taste, or touch, do not scruple to rob tangible ideas. And yet, as John Stuart Mill has it:—"No limit can be set to the importance, in a purely productive and material point of view, of mere thought." Manufacturers of thread, of buttons, or of crinolines, may earn fortunes, but men refuse to pay for the ideas manufactured by men of genius. The pirates of Watt's patent were doubtless encouraged by the success of similar manœuvres against Hargrave, Arkwright, and Crompton, the three first inventors of spinning. Mr. Farey, the distinguished engineer and scientific writer, says—"Of the three inventors of spinning, Hargrave, Arkwright, and Crompton, to whom the nation have owed so much, the first was persecuted, and died in the greatest poverty, amidst a population who were rising to opulence by his means. Arkwright possessed a vigour of mind to command, control, and instruct workpeople far beyond the talent of a mere artist or inventor, and succeeded in realizing a princely fortune by his manufactory; but his money was not gained by virtue of his inventions, for the bulk of it was acquired after his patent was set aside, and others who invented nothing, but merely copied what he did, made immense fortunes by spinning, as well as himself. Crompton, whose combination of Hargrave and Arkwright's inventions in the mule, has more than doubled the national advantages conferred by his predecessors, was, like Hargrave, ruined in his circumstances, and languished in poverty during a long life in the very towns which had grown up from insignificance to wealthy importance by the practice of his inventions. In 1812, his case reached the knowledge of Parliament, and £5,000 reward was given him; but it came too late to have the effect of removing the established impression, that an inventor is almost certain to be ruined, even if his invention succeeds, and proves ever so valuable to others."

The formal objections against Watt's patent, act, and specification, seem to have been much stronger than those which were successfully urged against Arkwright's patents. In fact, the specification of 1769 did not put the public in possession of the invention. Nevertheless, the mere fact of attacking the patent, on the score of its being informal, showed great immorality on the part of the pirates; a technical defect in a title-deed does not give an honest right to another's land. Fortunately for Watt, England and the world, right at last prevailed, and Watt long afterwards "used to call the specifications his old *and well-tried* friends."

If Watt had been refused a prolongation of his patent, or if his patent had been upset, it is not at all improbable that we should have soon felt disastrous political effects from this cause. "It is our improved steam-engine," wrote Lord Jeffery, in 1819, "that has fought the battles of Europe, and exalted and sustained, through the late tremendous contest, the political greatness of our land. It is the same great power which now enables us to pay the interest of our debt, and to maintain the arduous struggle in which we are still engaged, with the skill and capital of countries less oppressed by taxation." Even supposing that the steam-engine had been put aside for only 20 years, we should have lost the increase of wealth that enabled England to meet the tremendous wars of the first French Republic and Empire.

The anxiety and bitterness, however, engendered in Watt's mind by these attempted piracies, were very great. Watt wrote in 1782:—"If our right cannot be supported by law or custom, it is time we knew it before we waste more of our lives improving machines for the benefit of scoundrels." Later, he wrote:—"I wish my head and mind to be in the grave; and I fear they will not rest sooner." Watt was tempted in the anguish of his mind" to "curse his inventions;"—to declare that "there is nothing more foolish than inventing;—and that nine-tenths of mankind are knaves, and a large proportion of the remaining one-tenth fools." He called London solicitors "the anthropophagi of London." No wonder; for Mr. Muirhead saw one solicitor's bill alone to the tune of nearly £6,000 for the last four years of the patent! It has often struck us, that what with railway bills for civil engineers, and patent cases for mechanical engineers, the legal profession has profited more than any other class by practical science. The legal profession is so well represented in Parliament—the fountain-head of all modern English law—that we may never see any changes placing the men of matter in a more favourable position to the men of words.

Cheap litigation is a thing that is absolutely wanted by patentees and the public. The Committee on Patent Law of the Society of Arts, in 1851, quoted the following statesmanlike remarks of Lord Langdale, then Master of the Rolls:—"I consider that to check litigation by means of expense is pernicious to the public. Litigation may be most usefully prevented by cutting off its sources; but if the causes or sources of litigation are existing, the only mode of preserving the peace of society is to allow litigation to take place, and to make it easy. It is a great object of litigation to cast off the causes or sources of litigation: that I conceive to be the object of Government. But when the sources of litigation unhappily exist, instead of allowing them to rankle and fester in the minds of parties, the best and most prudent course is to let them go before an impartial judge, who may decide the matters in difference between them; and this is litigation.

The litigation in patent cases will, however, always be more or less expensive, even if such cases be less in the hands of the legal profession. The witnesses form the great expense in these cases. At present, the best talent must be obtained in both law and science. Cheap patents would be of no use as long as patent litigation is dear. What is a patent but a vested right to bring actions for infringement? On the other hand, of course the public ought to be protected at a cheap rate against undue assumptions of patent rights.

H.

ANALYTIC UNIVERSAL TELEGRAPHY.*

Notwithstanding the vast progress which has already been made in the practice of Telegraphy, much more remains to be effected. Hitherto the world has been indebted to comparatively a few persons, and those mainly Englishmen, for the advancement of the science, but now that the attention of ingenious men of all countries is directed to it, we may calculate with certainty upon its further and rapid development. The publication of the pamphlet, the comprehensive and rather ambitious title of which is placed at the foot of this column, will no doubt induce a considerable amount of curiosity, and some discussion. We are disposed to think, too, that the little work is really a valuable contribution to the literature of Telegraphy. Any attempt indeed to simplify the process of transmitting messages through the medium of the "magic wires," and to lessen its cost, must be received with favour, and deserves consideration. The position which the author of "Analytic Universal Telegraphy," holds in the Geographical Society of France is such as to give especial weight to his propositions, whilst his own faith in their practicability and value is witnessed by the fact that he has patented them in England, Belgium, France, and the United States.

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* Analytic Universal Telegraphy; an International Telegraphic Language, simple, accurate, and three times shorter than the system at present in use, presenting neither the difficulties nor inconveniences of other cyphers. By Count D'Escayrac de Lauture, Member of the Committee of the Geographical Society of France, &c. &c. London: John Camden Hotten, Piccadilly.

The Count is very enthusiastic in enunciating his belief that a universal telegraphic language is easily obtainable, and that the system upon which it is based can readily be adapted to all existing telegraphic apparatus. His reasons for coming to conclusions so important, and if true, so likely to become illimitably advantageous to the human race, are given in an early page of the pamphlet: "A philosophical and thorough study of language has led me to the conclusion that language everywhere, and always, passes from a synthetic to a more and more analytical form; that different nations brought into contact come, in order to understand each other, to a simplification of their grammar, which becomes the more analytical in the same ratio as those nations are more amalgamated with others, as their empire is of greater extent, their civilization more ancient, and of a higher development. It will be sufficient to cite the English language as an example of this law, which has to my apprehension been clearly established by numerous facts.

"I have then thought proper to express all the grammatical accidents of a principal idea (the tenses of the verbs for instance) by separate signals, which are the same for all words and for all languages. This algebraic notation enables me, with the aid of a very small number of signs, to give all the tenses and all the persons of all the verbs. Another combination, equally simple, enables me to form instantly an indefinite number of expressions always immediately intelligible. Moreover, it enables me to form adjectives, adverbs, &c., and finally to pass from the substantive to the verb that corresponds to it, and *vice versa*."

Here, therefore, is to be found the basis upon which the learned gentleman founds his system, and it is clear that the theory has much to recommend it to the notice of international telegraphists. Further on we are told that "nearly all dispatches are about special subjects; they are either military, commercial, medical, or relate to the money market. Each of these different subjects will (by his system) possess a particular vocabulary of four hundred and fifty, or six hundred words, if the alphabet contains thirty letters. These words will be classed in small groups, like the grammatical signs, according to the affinity, or the difference of the ideas they represent, and inscribed, like the grammatical signals, on tables divided into small squares, each of which will contain a word. Every line and every column of those tables will be designated by one of the letters of the alphabet, and every word will be translated by the two letters of its line and column."

It is impossible for us to do more than indicate generally the method by which the Count de Lauture proposes to accomplish the great task he has marked out for himself, but he has gone with extreme care into all the details of that method in the pamphlet under notice, and furnished the tables and signs by the use of which he believes universality of communication is to be attained. The only objection which he supposes can be raised to his system is that of its extreme "delicacy" and consequent liability to error. This anticipated objection is combated by the assertion that there is this difference between dispatches in cypher under the present system, and under that proposed; "that he who transmits or receives the first, transmits or receives what he does not understand, whilst he that shall receive or transmit the latter will be able, except in some cases, to understand and rectify them." "It will be impossible," says the advocate of the universal system, "for the transmitter or receiver who practices it to mistake the grammatical signals or those in common use of the first table, and those signals will compose nearly two-thirds of every dispatch. An error in the other signals, a mistake difficult to commit, will be generally self-evident, and a glance at the nearest words in the same table will be sufficient to correct it."

In fine, the author and patentee of "Analytical Universal Telegraphy" is, like almost all other authors and patentees, enthusiastic in favour of his own plans. It will be for those who are directly interested in telegraphic improvements to examine and test those plans, apart from prejudice, and with a determination to do justice to their distinguished projector.

One other point we must advert to before leaving this highly-interesting subject, and it has reference to the probability of the general introduction hereafter of automatic contrivances for the transmission of telegraphic messages. Everything seems to point in that direction. Professor Wheatstone, as is well known, invented a machine for the purpose, and no doubt others will follow in his footsteps. When that desideratum is arrived at the chances of error will be materially diminished. Dispatches will then be composed and revised at leisure by the same party who translates them, and afterwards passed to the machine which will transmit them without the probability of error, and with greater rapidity than they can at present be forwarded.

Those who wish to learn more of the new system of telegraphy must be referred to the publication which has incited the foregoing remarks, and which, we feel confident, cannot be perused without advantage. Telegraphy has enjoyed a brilliant past, and we are assured that a yet more brilliant future awaits it. We do not despair of seeing another and a durable Atlantic cable stretched across the ocean's bed, uniting us to our kindred, and vibrating with messages of peace and love. The animated discussion which followed the reading of Mr. Masey's excellent paper on the "Submarine Telegraph" at the Society of Arts last week, gave evidence of the interest which is felt by scientific men in the subject, and in truth all circumstances tend to demonstrate the fact that Telegraphy must be far more widely diffused. Should the Count D'Escayrac de Lauture succeed in realising his views, it will be possible by-and-bye for a merchant of London to converse freely with a native tea grower in the Celestial Empire without the aid of an interpreter!

INSTITUTION OF CIVIL ENGINEERS.

At the weekly meeting of the Institution of Civil Engineers, on Tuesday last—John Hawkshaw, Esq., president, in the chair—the paper read was, "On the Woods used for Sleepers on the Madras Railway," by Mr. Bryce McMaster, M. Inst. C.E.

The native wood sleepers having hitherto been found for the most part to fail—on the Madras railway between 30 and 40 per cent., requiring to be renewed annually—the author undertook an investigation with a view of ascertaining the causes of this deterioration, and whether those causes could be overcome, so as to render available the vast resources of India. Thirteen hundred sleepers, of sixteen different woods, were submitted to careful examination and scrutiny twice at an interval of twelve months. The sleepers were variously placed, both on embankments and in cuttings; in some cases they were entirely covered with ballast to a depth of 4 in., while in others they were, as much as possible, uncovered, and completely so from the rails to the ends, the ballast being only raised 2 in. in the middle of the way, and sloped off so as to carry away the water under the rails. From these observations it appeared, that only five woods—Chella, Woonjay, Eloopay, Kurrah Murdah, Palay, and Karavalum,—were sound at the end of two years, the other eleven not lasting even that time. Also, that when the sleepers were uncovered, decay was less rapid than when they were buried in the ballast. The plan of leaving the sleepers partially uncovered had many advantages; it effected a saving of the ballast, allowed the defects to be more quickly detected, and kept the sleepers drier. It had been urged that the heat of the sun would split the sleepers, and cause the keys and trenails to shrink; but from experience the author was enabled to state that, while amongst the "uncovered" sleepers there was a large proportion "beginning to split," or "useless from being split," there was, on the other hand, amongst the "covered" sleepers, a still larger proportion "beginning to rot," or "useless from being rotten." It was also noticed, that of the sleepers "beginning to rot," 19 per cent. had commenced under one or both chairs. This was due to the retention of moisture under them, and might be remedied, the author believed, by tarring the seats of the chairs. As regarded the trenails, where the sleepers were rotten, the trenails were invariably found to be in the same state; while when the heads were exposed to the sun he never found them loosened by shrinking. Another objection was, that the road would be more liable to buckle and twist, but this was not found to be the case on the 40 miles of line, thus ballasted and opened for traffic, on the division under his charge. Trenails made in India cost £2 10s. to £4 per thousand, and the woods generally used for the purpose were Vengay, Kurrah Murdah, Erool, Porasa, or satin-wood, and Trincomalee. The three woods first-named were also extensively employed for keys, which were considerably larger than usual; but teak keys seemed to be the best, and their cost did not exceed £6 per thousand. From personal observation and inquiry, the author thought the following woods would make really good sleepers, to be used plain:—Teak, Saul, Sissoo, Pedowk, Kurrah Murdah, Aucha, Vengay, Chella Woonjay, Erool, Karavalum, Dud Eloopay, and Paulay.

The sleepers which had failed on the Madras Railway might be divided into two classes—those which were originally of perishable woods, and were, therefore, unfit for the purpose, and those which, although of good woods, had been cut from young trees, and not been allowed to stand till old enough. The first arose from want of experience of the nature of Indian woods, the second to the absence of a proper system of working the jungles. The conditions under which the sleepers were supplied to the railway company, either through native contractors possessed of capital, or by purchase direct from the wood-cutters or others, having been found to fail, the author suggested that in future the company should send their own agents, with sufficient establishments, into the jungle to cut down the wood, that the wood-cutters should be furnished with proper appliances, and their operations be carefully superintended. This was done in one or two instances on the Madras Railway with great success. In particular, from the Palghaut jungles Mr. Ross, one of the resident engineers, was able to furnish sleepers for nearly eight districts, while on other portions of the line the supply required for one district of 25 miles could only be obtained from a great variety of sources. But as the Indian jungles abounded in woods of too perishable a nature to allow of their being used plain, the author recommended that the sleepers should be creosoted on a much larger scale than had yet been attempted in that country, as those so preserved which had been sent from England answered admirably. The process had not yet been fairly tried in India, as only Saul, Teak, Soondry, Sissoo, and other hard close-grained woods had been submitted to it; while the cheaper, more easily procured, lighter, and more open-grained woods, had been neglected. English creosoted sleepers led, say, 100 miles by rail and 50 miles by road, cost 9s. 6d.

each; while good, native wood, plain sleepers delivered at the works, averaged 6s. each. If establishments and apparatus for creosoting were erected in convenient positions near to each extensive jungle, it was believed sleepers of common wood might be procured for 4s. 6d. each, and be creosoted for about 1s. each.

In proof that the resources of India were likely to be equal to the demand, reference was made to the Report of the Conservator of Forests for the official year 1859-60. From this it appeared that from the Salem Jungle alone—one probably of 20 in the Madras Presidency—about 246,000 sleepers, or sufficient for 133 miles of railway, had been cut during that year. Of this number about 62 per cent. could not be used plain, and were practically useless, owing to the want of artificial means for preserving those of a perishable nature. But as a supply from each jungle of 2,000 sleepers per month would provide for the construction of 500 miles of railway in that presidency within the next five years, and for a renewal of 33 per cent. of those already laid, it might be confidently anticipated that the supply would not fail, if means were taken to make the naturally perishable sleepers last a reasonable time.

In conclusion, the author recommended that a fair trial on a new footing be made with the native wood sleepers; that all woods now known, or hereafter found to be good, be used plain, and that others be avoided; that proper care be taken in the selection, felling, and seasoning of the timber; that the sleepers be tarred under the seats of the chairs, and that they may be laid in dry ballast, raised slightly in the middle, and sloped off, so as to throw the water under the rails.

It was announced that the discussion upon Mr. McMaster's paper, "On the Woods used for Sleepers on the Madras Railway," would be taken at the next meeting, Tuesday, February 10th, when, if time permitted, the following papers would be read:—"Description of the Drainage of the Borough of Dundee," by Mr. John Fulton; and "Description of the Drainage of Newport, Monmouthshire," by Mr. A. Williams, Assoc. Inst., C.E.

PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS.

On the Manufacture of Hemp and Wire Rope.

By Mr. Charles P. B. Shelley.

Ropes are mainly constructed either of the fibres of the hemp plant (canabis sativa) or of iron wire. Other vegetable substances and other metal wires are also used; but in the present paper only the two important manufactures of hemp rope and iron wire rope are referred to: and as the treatment of the hemp fibres and manufacture of them into rope is quite different from the formation of iron wire rope, the subject naturally divides itself into two branches.

Hemp rope.—Of the other substances besides hemp which have been found useful and profitable for rope making, the most important are—"manilla," the fibres of which are obtained from the bark of a wild species of banana, grown in the Philippine islands, manufactured into a rope commonly known as "white rope;" jute, grown in Bengal, the fibres of which are used for adulterating hemp; cocoa-nut fibre for inferior ropes; Indian hemp, or "sunn," the high price of which however keeps it out of the market; and Spanish grass or "esparto." Of these "manilla" is the most common substitute for hemp. The machinery employed for manufacturing any one of these several fibres into rope is similar, with slight modifications, to that employed for hemp. The intestines, hide, and hair of animals are sometimes used for rope for special purposes; and the Romans are said to have formed ropes by binding together rushes (junci), whence the name "junk" for cable is believed to be derived. A variety of specimens of hemp and of other fibres, together with ropes of different makes, are exhibited, which have been kindly furnished to the writer by Messrs. Wright, of Millwall. The manufacture of hemp ropes is still carried on by hand, the ingenious machinery invented for the purpose by the late Captain Joseph Huddart, and for some time employed at Deptford dockyard, having been abandoned, and the old plan of hand making again reverted to.

The hemp plant from which the fibre is derived consists of a woody cylindrical stem, surrounded by a fibrous peel held together by a glutinous substance, the whole being protected by a fine epidermis or skin. The fibrous part, which is the portion used in the manufacture of ropes, is strong, flexible, and tenacious; but the woody core and the external skin are useless, and it is necessary that they shall be separated from the fibres. This is effected by "retting," that is by soaking the hemp stalks in water and allowing fermentation to take place, thus rotting the woody and glutinous parts and leaving the fibres free. The hemp is pulled up by the roots, and the flowers and leaves stripped off, and it is then immersed in a pond or running stream where it is allowed to remain until fermentation takes place, the time of immersion being dependent upon the degree of humidity and temperature of the atmosphere, and also upon the quality and growth of the stalks. There are many objections, however, to this system of retting; the principal is that the stalks not all being of the same strength of growth, and also occupying different positions in the immersed heap, some are liable to suffer from decomposition and be weakened while others may not be sufficiently steeped, rendering it difficult in the processes which follow to separate the woody matter from the fibres, and thus rendering the hemp harsh and inelastic. Another serious objection is that the vapour arising from the putrefaction of the stalks renders the neighbourhood of the stream or pond where the retting is carried on unhealthy. Moreover, this mode of retting unavoidably deteriorates and wastes the fibre; for a single stem of hemp is said to be composed of 70 to 80 per cent. of wood and 20 to 30 per cent. of fibre, whereas the fibre obtained by the present method does not exceed 16 per cent. and falls as low as 12 per cent., the remainder being wasted in the retting. Several other modes of preparing the stalks have been tried, such as steaming them, treating them with lime water or alkaline solution, and also adding materials to the mass of soaking stalks with a view of inducing speedy fermentation; but generally these plans have failed and there is still room for improvement in this respect. After the stalks have been dried they are broken at a hand break or by rollers, and the woody part is separated by "scutching," somewhat in the same way as in the case of flax. The hemp thus prepared is packed in huge bales, each bale of Italian hemp, jute, or manilla, weighing about 2½ cwts.

In order to form the strongest rope out of a given quantity of material, whether hemp fibres or metallic wire, the fibres should be laid parallel alongside one another and secured at the ends, so that they may take any tensile strain put upon them in the direction of their length; the strength of such a rope will be equal to the strength of each fibre multiplied by the number of fibres in the section. Hemp fibres rarely exceed 4 ft. in length, so that the above method of making a rope exceeding 4 ft. in length will not apply to that material. In order, therefore, that the fibres may be securely and continuously connected together, they must be placed parallel to one another, with the end of one fibre overlapping the end of its neighbour; and to prevent the fibres slipping from one another, friction is produced amongst them by twisting; but as the strength of the fibres is diminished when they are twisted out of the direction of the tensile strain which they are to sustain, no more twist should be given than is necessary to impart sufficient friction to prevent them from slipping and parting endways. It must be remembered that fibres of hemp, like metallic wires, have not the property of "felting," or uniting into one length by a kind of entanglement or matting together, in the manner common to the fibres of wool and other materials used in spinning. If a bundle of parallel fibres be twisted, those on the outer surface will be stretched and strained considerably more than those near the centre; and the further they are from the centre, the more will they be strained. Hence, in constructing cordage it is necessary to form or build it up gradually from small bundles. Thus the primary object of the rope-maker is to get the longest, finest, and strongest fibres which can be economically obtained; and next to lay them in bundles parallel to one another, and in continuous juxtaposition, giving them ultimately such a degree of twist that the friction amongst the fibres of the bundle is equal to their tensile resistance.

When the fibres are laid parallel and in continuous juxtaposition, they are said to form a "sliver;" and the sliver when twisted is said to be converted into a "thread" or "yarn;" and a number of yarns laid parallel and in juxtaposition, bound round by an external "serving" of yarn to hold them together, form "selvagee," which is the simplest construction of rope. If each of the yarns in the selvagee bore its fair share of strain, this would be the strongest kind of rope; but the objection to its more frequent use is that the outside "serving" of yarn frets away and allows water to enter and rot the yarns inside. In order to overcome the objections to selvagee, ropes are made of "strands," each strand consisting of a number of yarns twisted together, the strands being again twisted into the rope; the class of rope depends upon the number of strands and their arrangement. The yarn is twisted in the process of manufacture by a motion to the left from the right, or contrary to the motion of the hands of a watch, producing what is termed in rope-making a left-handed twist, being a spiral corresponding to the thread of a right-handed screw. The twist of each strand is in the opposite direction to that of the yarns composing it; and the twist of the rope itself is again in the opposite direction to that of the strands, or in the same direction as that of the yarns.

Ropes are commonly divided into three classes known as "hawser-laid," "shroud-laid," and "cable-laid" ropes. "Hawser-laid" ropes are composed of three strands twisted together; the number of yarns for each strand in different sizes of hawser-laid ropes is dependent on the diameter or number of thread of the yarn. "Shroud-laid" ropes are composed of four strands. "Cable-laid" ropes are composed of three hawser-laid ropes twisted together. "Cablets" are small cable-laid ropes measuring from 1 to 10 inches in girth; larger sizes are termed cables. Shroud and hawser-laid ropes seldom exceed 10 inches in girth. A core or "heart" is used in shroud-laid ropes; it is made of rope and is placed in the centre of the strands, running from end to end of the rope with the strands laid round it. In old worn out ropes the core is always found to be broken in consequence of the stretching of the strands; for the strands being twisted spirally and the core straight, the strands will give more under a load than the core, which cannot, therefore, be relied upon for adding strength to the rope; but it assists materially in keeping the strands in position during the manufacture of the rope by hand. Flat hempen ropes are made of four or six ropes, each composed of three strands, and laid alternately to the right and to the left; these are stretched side by side and sewn through in a zigzag direction.

Before the hemp is spun into yarn it has to be freed from dust and hard knots, and the fibres combed so that they may be separate and parallel to one another. This process is called "heckling," and is done either by machinery or by manual labour; the machinery for the purpose is similar to that used in the preparation of flax. When done by hand, each man is provided with two combs or "heckles," one coarse and the other fine. The heckle is formed of a number of straight sharp-pointed steel pins, fixed with the points upwards in an inclined board; the length of the pins, their thickness, and pitch or distance from centre to centre, vary with the material to be heckled, those used for manilla being much finer and closer together than those used for hemp; the pins for heckling hemp are about 10 in. long, and about 2¼ in. pitch centre to centre. The dresser, after untying and opening one of the heads of hemp, takes hold of the fibres at about the middle of their lengths and throws one end of them loosely over the pins, and pulls the bundle towards him; this is repeated until about half the length has been thoroughly combed by drawing through the heckles. The bundle is then turned end for end, and the other half heckled in the same way, after which it is finished on the fine heckles. The hemp is now entirely free from knots, and has a glossy, silky appearance; it is distinguished as "long hemp," and is said to be "topped;" and the handful of hemp is then doubled in the centre, and tied at the ends, in which state it is called "doll," and weighs about 2 lbs. The tow or fibres retained by the heckles are called "shorts," and if the shorts are to be worked into the yarn they are tied up into the bundle of "doll." The dresser applies a little oil occasionally to the points of the prongs, for the purpose of reducing the friction; and in dressing manilla, soap is sometimes applied to the fibres for the same purpose, in addition to oiling the heckles. Each bale of Italian hemp, jute, or manilla weighing 2½ cwts., or 280 lbs., loses by heckling about 80 lbs. of "shorts" and 10 lbs. of waste, leaving 190 lbs. of "long hemp" from the bale. One dresser heckles in a day 8 cwts. (finished weight) of St. Petersburg hemp, or 2 cwts. of manilla, or 1½ cwt. of jute.

The next process which the fibres undergo is that of spinning into yarns. Hand spinning is done on a long strip of ground called the rope walk, which is generally covered by a low roof; sometimes the shed has an upper floor with a low roof, and then the spinning is done on the upper floor, and the other parts of the manufacture on the ground. The length of the walk and shed is about 1,230 ft., or a little over 200 fathoms, and the width about 30 ft. The tie beams of the roof are placed every 30 ft. or 5 fathoms apart, and carry a row of hooks on the underside. That end of the walk at which the spinning machines are placed is called the "head" or "fore end" of the walk, and the opposite end is the "foot" or "bottom end" of the walk.

The hand spinning machine, shown in figs 1 and 2, is formed of two cast iron frames with a band wheel A between them, driven either by a man at the winch handle at the back or by steam power. A band passing round the wheel passes over twelve wood rollers or "whirls" 1½ in. diameter, as shown in enlarged view, fixed on steel spindles about ½ inch diameter, which revolve in notches or bearings in the brass discs C screwed in the frames of the machine: the spindles are kept in their bearings by a riband of wrought iron screwed upon the outside of the frame. On the back end of the spindle is a shoulder, and between this and the brass disc is a loose collar, to take the pull of the yarns in spinning; the spindle is kept in by a finger D fixed on the back of the frame. The front end of the spindle is drawn out into a hook E. The notches are for the purpose of forming fresh bearings for the spindles; there are eight notches in each brass, and when one notch is worn down the brass is turned to bring another notch round: when the whole of the notches are worn down a new brass is put in. The twelve hooks and "whirls" are set upon the semicircular upper part of the machine, and are made to revolve by the band which passes over them from the driving wheel A.

Each spinner, before beginning to spin, takes up a bundle of hemp, sufficient in quantity to spin one "thread" of yarn of the required length; he places the "bight or middle of the length of the fibres in front of him, and turns the ends round his waist, crossing them behind. If the "shorts" are to be worked into the yarns they are tucked below the bight. Each spinner carries in his right hand a piece of stout list. There are twelve spinners to each machine, one to each hook. The spinner draws from the bight or front of the bundle round his waist a sufficient quantity of fibres for the size of the yarn or thread about to be spun, then forming a "sliver," which he twists with his fingers, and hooks the bight of the sliver on to one of the revolving hooks of the machine. He then walks backwards towards the bottom of the rope-walk, drawing the hemp from his waist, and forming a sliver with his left hand, pulling some of the fibres back if they come forward too quickly, and drawing some forward if there are not enough to keep up the required size of yarn. The sliver passes through his right hand, with which, by means of the piece of list, he firmly gripes it, so as to "form" the yarn. The spinner thus prepares the sliver and forms the yarn, while the machine gives it the twist. Care must be taken not to place the ends of one set of fibres too near to the ends of the next set, not giving them sufficient lap, otherwise the yarn will part by the fibres, slipping endways from one another; and also to keep the fibres even and regular in thickness, in order that the yarn may be of equal strength throughout. The spinner's pace in walking backwards must be uniform and in accordance with the speed of the revolving whirls. The speed of the whirls and the amount of twist of the yarn is dependant upon the quality of the rope to be manufactured.

HEMPEN ROPE MAKING MACHINERY.

FIG. 1.

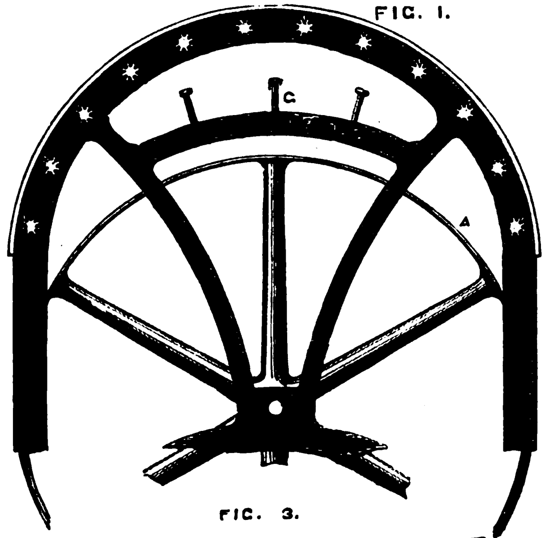


FIG. 2.

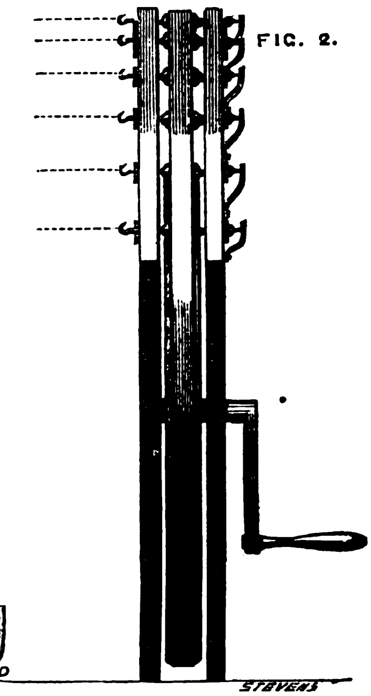
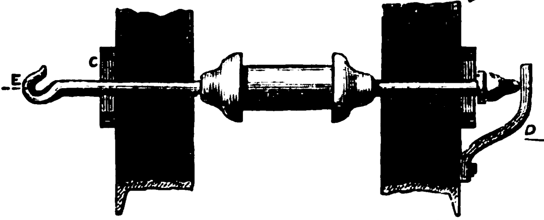


FIG. 3.



The twelve spinners are divided into three sets of four each; four risers, four middlemen, and four leaders. The four risers work from the four hooks on the left side of the machine, the four middlemen from the four middle hooks, and the four leaders from the four hooks on the right of the machine. All the twelve spinners start at once from the machine in the morning. The four risers spin down the walk a yarn 1-3rd of 160 fathoms long, and then stop, while the middlemen and leaders continue to spin past them. The four yarns of the risers are now unhooked from the whirls by a man at the top of the walk, and are passed each through a hole F in the frame of the spinning machine, fig. 1, to a reel at the back, upon which they are wound; the men at the bottom end of the yarns still hold on so as to prevent the yarn from untwisting, and follow it up to the machine as it is wound on to the reel. They then twist the ends of these yarns on to one of the holding pins G, on the cross bar of the machine frame, and start spinning again with four fresh yarns which they will this time spin down to the whole length of 160 fathoms before stopping. The four middlemen spin down the walk a yarn 2-3rds of 160 fathoms long, and then stop, while the leaders still go on and pass them. Their four yarns are taken off the hooks of the machine and spliced on to the ends of the four yarns which were left on the holding pin by the risers; the yarns of the four middlemen are then wound on to the reel, the men following them up the walk and fastening the ends on to one of the holding pins: the middlemen then start fresh yarns of 160 fathoms length, and spin down the walk. The four leaders spin down the walk a yarn 160 fathoms long, and then they also stop, and their four yarns are taken off the hooks and spliced on to the ends of the four yarns left on the holding pin by the middlemen; the yarns of the leaders are then wound up on the reel, followed up by the men. So they go on till breakfast time, the three sets of men never being up at the machine together, and never more than four being there at one time, so that the three sets are always separated. After breakfast the risers commence with 2-3rds lengths, and the middlemen with the 1-3rd lengths, and thus the quantity of yarn spun is equalized between them.

(To be continued.)

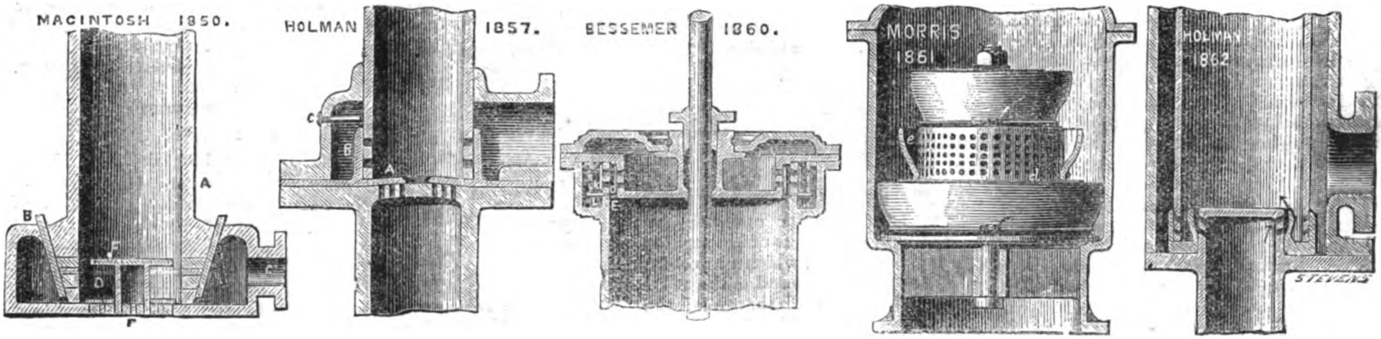
INSTITUTION OF MECHANICAL ENGINEERS.

THE sixteenth annual general meeting of the members of this Institution was held on Thursday, the 29th ult., at the house of the Institution, Newhall-street, Birmingham; **CHARLES F. BEYER**, Esq., Vice-President, in the chair.

The SECRETARY (Mr. W. P. Marshall) having read the minutes of the previous meeting, the annual report of the Council was then read, which showed the very satisfactory progress of the Institution during the past year, and its prosperous condition, with a considerable increase in the number of members, referring also to the large and important special meeting held in London last summer during the period of the International Exhibition. The annual election of officers then took place, Robert Napier, Esq., being elected President of the Institution for the the ensuing year; several new members were also elected.

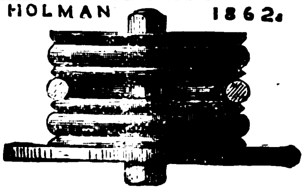
The first paper read was a "Description of the Apparatus used for Sinking Piers for Iron Railway Bridges in India," by M. JOSEPH F. STRONG, of Allahabad. The mode of sinking the piers described in the paper is an extension of the plan long in use among the natives in India for sinking wells and forming foundations for river forts and quay walls to the sandy ground, by building a well or cylinder of brickwork, and

HOLMAN'S PUMPS AND VALVES.



excavating the sand from the interior, so as to allow the cylinder to sink by its own weight until it has obtained the required hold in the ground, the sand being excavated by divers with a scoop called a "jham." The extent to which this plan can be carried out is therefore determined by the limit to which the native divers can execute the work, each one remaining under water about a minute at a time without any diving apparatus. In the application of this plan to the foundations of railway bridges, where a much greater depth and size of well are required a scoop of larger size, and worked entirely from above water, is employed. This is lowered inside the brick well, with its front cutting edge downwards, and is forced down into the sand by being lifted and dropped a few times with the weight of several men acting on a long pole inserted in a socket at the back end of the scoop. The scoop is then hauled up by means of a chain attached to an arm projecting in front, which tilts the scoop and draws it through the sand into a horizontal position; and the scoop full of sand is then drawn up out of the well by the windlass. The brick cylinders are built upon wrought iron kerbs at the bottom, and sink gradually by their own weight, as the sand is excavated from their interior; and successive lengths of brickwork are added above the water, until the required depth of about 43 ft. in the ground is reached. Ten cylinders are sunk together to form a single pier, being afterwards filled up solid inside with concrete and rubble stone, and also between the cylinders above the ground level, so as to form one compact mass of masonry for the foundation of the pier. For the purpose of pitching the iron curb in the first instance for building the brickwork upon, in places where the bed of the river is always under water, an artificial island is temporary formed on the proper site by throwing down sand bags in the river, and filling in sand on the upper side of them till the surface of the water is reached. This is the mode of sinking piers that has been carried out on the main line of the East Indian Railway, in the construction of the iron bridge over the River Jumna, at Allahabad, near its confluence with the Ganges. The bridge is composed of sixteen openings of 205 ft. clear span each, crossed by wrought-iron girders, and the brick cylinders are sunk to the depth of 43 ft. in the sand before being filled in with the concrete. The river is only about 12 ft. deep at low water, but rises 45 ft. higher in flood time.

The next paper was "On a Type Composing and Distributing Machine," by Mr. **William H. Mitchel**, of London. In the composing machine the types are ranged in parallel reservoirs placed nearly vertical, from which they are conveyed to the setting-up wheel by means of a series of parallel endless bands, one to each type, and a diagonal collecting band, upon which the several types are delivered successively by the parallel bands. The diagonal band is driven at a higher speed than the parallel bands; and this difference in speed of the bands neutralizes the effect of the different distances at which the several type reservoirs are situated from the common point of discharge on to the setting-up wheel, which would otherwise cause the type from a nearer reservoir to reach the wheel sooner than one from a more distant reservoir, although the latter had been first started. The total time of travel of every type from the type reservoirs to the setting-up wheel is thus rendered the same, whatever be the distance over which the type has to be carried in the machine; and the types are consequently set up in the exact succession which they are played out from the type reservoirs. The selection of the types by the compositor is performed by a row of finger keys, one key being appropriated to each type; by the depression of any key one of the corresponding types is liberated from the bottom of the type reservoir containing that letter, and dropping on the travelling band beneath is conveyed by it to the setting-up wheel. The types fall into notches in the circumference of this wheel, which is a racket wheel like a circular saw revolving backwards; they are carried round by the wheel into a vertical position and set up one after another in a row, which is pushed forwards successively by the revolution of the setting-up wheel, advancing through a distance equal to the thickness of each type that is added; the whole row slides securely in a groove until the required length of type is set up, which is then removed by hand and justified and corrected in the ordinary manner. In the event of two types being accidentally played out simultaneously, so as to reach the setting-up wheel together, one of them is thrown out laterally, and falls clear of the wheel without injuring the machine or stopping its action. The machine is capable of composing at the rate of six letters per second, but its speed is practically limited by the skill of the operator; one machine is capable of employing two compositors. In the distributing machine the separation and distribution of the different types is accomplished by means of nicks, one, two, or three in number, made in the edge of each type, the size and position of which are different in every type. The line of letters to be distributed is ranged in a long feeding groove, and brought up against an inclined stop plate, which fits into the highest of the nicks in the foremost type; and the width of the nick being proportional to the thickness of the type, the advance of the line of letters is thereby determined according to the thickness of the foremost letter, so that the back face of each letter is brought up exactly to the same line when it comes to the end of the feeding groove, and thus not more than one letter at a time can be cut off for distribution. The foremost letter is then cut off by a vibrating striker, and drops into one of the grooves in the circumference of the distributing wheel revolving horizontally beneath the striker. In this grove the type remains suspended hanging on a projecting pin which catches the lowest of the nicks in its edge; and is carried round by the distributing wheel until its foot encounters one of a series of inclined stops fixed at different levels on the table of the machine, whereby the type is thrown off the suspending pin and drops into the receptacle appropriated to that particular letter. In the case of types having a second distributing nick, the first or lowest nick is cut nearer to the bottom of the type, so that while suspended at this first nick the foot of the type is kept high enough to clear all the stops in the first class of inclines, and the type is carried forward to a second, third, or fourth class of similar stopped inclines, according to the height of the lowest nick above the foot of the type; and being thrown off the suspending pin by a projection at the commencement of its own particular class as it then descends as far the second nick in its edge, by which it is carried back still further on the suspending pin until its foot meets the individual stop belonging to it in the class, when the type finally drops off into its own receptacle. The nicks in the types are readily cut with great accuracy by a kind of plane, which cuts all the nicks simultaneously in a long row of type of the same letter. A stop action is provided, to stop the motion of the distributing machine by a self-acting arrangement, in the event of any type accidentally sticking in the grooves of the distributing wheel. The machine distributes in regular work eight thousand letters per hour, and requires only the attention of a boy. The composing and distributing machines, which were shown in working order, are each constructed to take forty sorts or letters, including all the letters required in the general run of printing work of a regular description. The extra sorts, such as small capitals, italics, numerals, &c., are put in by hand in the composing machine, and are afterwards distributed also by hand, being rejected by the distributing machine, since they do not contain the suspending-nicks, by which the distribution is effected in the machine. Several of the composing and distributing machines have been in use for some years, and are working successfully.



The meeting then terminated. In the evening a number of the members and their friends dined together, in celebration of the sixteenth anniversary of the institution.

HOLMAN'S PUMPS AND VALVES.

Sir,—Doubtless some of your readers are readers also of the *Engineer*. I beg permission, therefore, to correct a statement which appeared in my specification published in the *Engineer* of last week, as it is likely to do me considerable injury. I am more desirous to do so as the patent was inserted in the Mechanics' Magazine at the same time. The statement referred to runs thus:—"Valves of the construction shown were patented by Mr. Bessemer about three years ago." To save time I hand a copy of my reply to the foregoing statement, together with a duplicate of the illustrations.

I am, &c.,
Stephen Holman.

To the Editor of the Engineer.

Sir,—The paragraph which you imported into my specification published in the *Engineer* of last week affects me personally, and many others commercially. I claim, therefore, to reply through the same medium in self-defence, and in the interest of my clients.

I cannot for a moment suppose there was any intention to serve Mr. Bessemer at my expense, and in this case at least there would be no charity in "robbing Peter to pay Paul." I notice, however, a remarkable coincidence. viz., the omission of the following important paragraph :—" In this pump I leave myself free to use the flexible cylindrical valves according to my specification, dated 16th June, 1857, No. 1679, or the disc valves as frequently used in pumps, or new valves and seats made according to the following description in the second and third parts of this invention."

I hope to show by the assistance of the accompanying illustrations, that the above cited paragraph should have appeared in its proper place, and that the following indefinite and mischievous statement was an unhappy substitute for it, viz.: " Valves of the construction shown were patented by Mr. Bessemer about three years ago." Now, it would have been some mitigation of the evil (seeing there are two distinct kinds of valves in my patent) if you had qualified your assertion by giving reference to fig. 7 in the illustration, as that is the only valve to which Mr. Bessemer's bears any resemblance, and seeing that that valve occupied only a secondary position, both in my specification and drawing.

The illustrations of the various valves herewith give their history, as far as I have had an opportunity to trace it. The valve first on the list is by Messrs. Macintosh and Co.; I mean by this, that it was published by Messrs. Macintosh, as long ago as the year 1850, probably before. I enclose you their illustrated list, and am sorry I cannot at present give you the name of the inventor. The single cylindrical strap ring valve, with its perforated seat, is there shown, together with a separate disc valve for the suction or inlet. My valve of 1857, the second on the list, is a compound valve which accords with the following extracts from my specification, No. 1697 :—" The chief object of this invention is to simplify the construction of force pumps, by applying thereto an elastic compound valve, in place of the ordinary arrangements of clack and other valves. This valve is formed of a cup of vulcanized india rubber, which is applied to the lower end of the pump cylinder between it and the inlet pipe, so that its bottom covers the inner end of the pipe, while the lip or upper part of the cup surrounds and lies closely against the cylinder, which is pierced at that part with holes for the discharge of the water from the cylinder. In the bottom of the cup a tongue is cut or stamped out, so as to form a clack valve, which will be free to rise when pressure is put on its under side, and to close when the pressure is removed or reversed. When by the repeated strokes of the piston in the cylinder, the water has been drawn up through the inlet pipe, the piston descends and forces the water through the later openings in the cylinder, the elastic material surrounding the cylinder yielding to allow of its passage. An obvious modification of this improvement will be a ring of india rubber, with flanges at right angles, or nearly so; the inner lip or flange shown at A will then form an annular valve like that which surrounds the cylinder shown at B, and closing openings made in the closed end of the feed pipe, will act like the clack valve before described; this cup or ring may also form a packing for the joint between the cylinder and its supply pipe."

The distinguishing feature of this compound valve is that it comprises both suction and delivery valve in one piece of material; and, as shown in the illustration, the fluid is admitted to and discharged from the barrel through perforated seatings.

Permit me to refer next to Mr. Morris' valves, the fourth on the list (as that appears to be the next of our acquaintance); these appeared in the *Engineer*, under date Sept. 20, 1861, and are single flat band valves secured at one edge and provided with perforated seatings as before described. You did me the favour to insert a letter in the *Engineer*, under date Oct. 4, 1861 (a fortnight afterwards), and as bearing upon the case in point I reproduce it, viz.:—

" *To the Editor of the Engineer.*

" Sir,—Observing the specification of Morris' valves in the *Engineer*, under date Sept. 20, 1861, I hand you a copy of my specification left at the Patent Office on the 16th June, 1857, No. 1,679, which establishes a prior introduction. These valves have been in use for the last four years in London, in some cases confined at the bottom, so that the upper part only is permitted to open for the discharge of the fluid; in others the ring of vulcanized india-rubber is free both at top and bottom, so that the valve may expand in a parallel cylindrical form, instead of being compelled to assume the conical form by reason of its being confined at either edge.

In the latter case, the valve is prevented from shifting out of its position by guard studs (shown at C), which project from the annular seat beyond the spread of the valve, when opened by and for the discharge of the fluid. I think it judicious to offer these remarks, so that Mr. Morris (whom I have the pleasure of knowing personally) and the public may not consider me infringing Mr. Morris' claims in my future use of the valves. " S. HOLMAN, C.H.E."

" 18, Canon-street, E.C."

A further reference to these valves was made, in the *Engineer*, dated Oct. 24, 1862, under the head of " Invalid Patents." The pump valves patented by Mr. Morris, of the Kent Waterworks, (No. 323) 1861, has been provisionally specified by Mr. S. Holman, in 187 No. 16579 :" thus you had three previous opportunities of mentioning Mr. Beesemer's patent, at either of which it would have been much more appropriate than in my specification of 1862. Mr. Bessemer's valves, as shown in the third illustration (being the third in the order of date), are the single flat band or strap valves; D is the inlet valve, and K the outlet valve. The valves being perfectly free throughout the depth, are kept in their position by guard studs at E and L; this mode of securing the valves is also mentioned in my letter dated September 20, 1861, given above. Mr. Bessemer's arrangement, as shown in the illustration, was with the view of forcing air entirely, and formed only a moderate portion of his famous scheme for the manufacture of malleable iron and steel. I read his specification, for the first time, on Saturday last, and shall never forget the ingenious way in which the air is admitted to the barrel by passing through the annular channels. I confess frankly that was a perplexing point to me, and led me ultimately to adopt the inserted barrel with the continuous delivery passage, common to both delivery valves. (Excuse this incidental digression from the immediate case in point. My admiration of Mr. Bessemer as a public benefactor, and my obligation to him as a patron in business matters, makes me regret that an ill-timed use of his name has rendered it necessary for me publicly to defend my patent right. I come now to illustration No. 5 on the list, which I presume is the one you thought analogous to Mr. Bessemer's valve. That, however, is a compound valve, combining inlet and outlet valve in one piece of material. I beg permission to state how I conceived a valve of that form to be practicable. It will be obvious that if a plain internal barrel is fitted with compound valve (as shown) at each end, that any pressure exerted by the cover would cause the barrel to be indented in the bottoms of the cups, if they were of the same flexibility at those parts, as they must necessarily be at the parts covering the perforations. Messrs. Warne and Co., a-year or two since, introduced their " Junction Rubber," the peculiarity of which is, that it may be made to any degree of hardness at one part, and flexibility at another; hence my application of it in the manner shown, and for the purposes described in my specification. Moreover, I could not possibly have been ignorant of the single band valves to which you allude. Just a word in reference to the valves as per illustration, No. 6; they are totally different in form to any of the others mentioned, and are provided with different seatings and water discharges, and seeing they formed a prominent feature in my specification, they ought to have been screened from the damaging influence of your vague assertion, which would appear to apply to all alike. I therefore beg to affirm that, " valves of the construction shown" were never patented by Mr. Bessemer at all.

I am, &c.,
STEPHEN HOLMAN.

18, Cannon-street, E.C.

SUBMARINE TELEGRAPHY.

ON the 28th of January last, Mr. T. A. Masey read an interesting paper before the Society of Arts. As our readers are familiar with most of the facts stated in the paper, we will not give it in full. The following is the concluding portion of the paper:—

I have now briefly reviewed the subject, but I have a few words to say about the proposed cables and telegraphing to America or elsewhere without the aid of wires at all. Hundreds of patents have been taken out for different kinds of cables, but the original spiral form of twisted wires for the outer covering, first adopted by Mr. Brett, still keeps its ground. It is impossible to say what form of cable will be adopted for the new Atlantic line; but no doubt every experiment and trial will be carefully made, and no expense spared to arrive at a satisfactory result; and when a suitable cable has been decided upon, and a careful supervision given to its manufacture, there can be no doubt that it will be successfully laid. Amongst other new inventions is that of Mr. Duncan's Ratan cable, which he advocates upon the grounds of its flexibility without elasticity, of its being imperishable in water, and of the cheapness at which it can be manufactured.

Another form of cable, containing some new combinations, has been adopted by the Indian Government for their cable of 800 miles down the Persian Gulf. The novelty which it possesses is in the manufacture of the copper wire, which is a single wire instead ot a strand of several, so much advocated, as affording great additional strength, and avoiding the possibility of a total fracture at one particular spot. But a strand has this disadvantage—that if one wire breaks, the sharp points are liable to start out and pierce through the gutta-percha. Want of solidity is also urged against a strand, as it is alleged that if water penetrates in any place to the wire it will pass along the wire as in a tube. To remedy this defect, the Gutta-percha Company propose to coat the central wire of the strand with Chatterton's compound, and bed the wire in it during the process of twisting.

Mr. Daft proposes to obtain the same object by bedding copper wires coated with brass in vulcanised india-rubber.

Mr Varley proposes using three or more insulated wires joined together at different distances. If any one wire (or two wires) be exposed by injury to the water, the current will eat it away, and thus increase the resistance of the escape without increasing sensibly the line; the more the wire is eaten away the better the cable becomes. Such a cable may be defective in twenty places, and yet work perfectly.

Mr. Newall unites the several wires of a strand with solder.

Mr. Latimer Clark, who, with Sir Charles Bright, are appointed engineers of the Indian Government, proposes to obtain this solidity by making the conductor in the shape of a solid wire, divided into three or four sections, longitudinally fitted, and rolled into each other, and they have adopted this form in the Persian Gulf cable now being manufactured by Mr. W. T. Henley.

The outside covering of iron wire is the old form, but it also is now coated with hemp, and a tarry composition to protect the iron from rusting, a plan which will be universally adopted in future after the experience gained with the Atlantic and Red Sea lines.

But while various parties have been at work devising new cables, another gentleman, a Mr. Haworth, has been at work to discover a means of conveying electric signals without any wires at all. He has taken out a patent and filed drawings of the apparatus, but I have not met one single gentleman connected with the science of telegraphy who could understand his process of action, or its probability of success, although the theory is an old one. I applied to him for some information relative to his experiments, but he is unwilling to communicate any particulars until the success of his plans has sufficiently demonstrated their practicability.

With respect to the comparative merits of gutta-percha and india-rubber, I may remark that one of the earliest substances used for insulating purposes was india-rubber, but owing to the difficulty of efficiently covering the wire, and from the oxidation which took place when it was exposed to the atmosphere, it fell into disuse after the introduction of gutta-percha; and, although universally admitted to contain insulating properties, far above any other substance, no attempts, I believe, were made for several years to perfect it for telegraphic purposes.

Messrs. Silver have, however, in the last few years, turned their attention to the subject, and have been rewarded by producing a substance called ebonite, which is being universally used for various insulating purposes.

They have also arrived at a perfection not hitherto obtained in covering wire. A mile length prepared by the Messrs. Silver, was submitted to the Government Scientific Committee, and reported on by them as containing the highest insulation ever attained.

They state in the report—"That india-rubber suppasses all other materials in the smallness of the amount of its inductive discharge, and the perfectness of its insulation." Although this testimony carries great weight, yet the substance itself has not hitherto proved very durable, nor has it been adopted to any great extent, but the manufacturers are sanguine enough to believe that, with the present and other improvements which may be made, it will one day surpass everything else.

As regards gutta-percha, no vegetable substance has yet been discovered which presents the same advantages to the electrician as this gum. Its many valuable properties are too well known to mention; suffice it to say, that it has never been known to decay under water, and, as far as experience goes, it may, in that case, be said to be indestructible when suitably protected. The manufacture of the article has now arrived at a perfection to leave nothing to be desired but that the supply may not fail.

At a recent repairing operation in the case of the Belgian cable (made by Mr. France, the Submarine Company's engineer), and which was broken by a ship's anchor, it was found that, although the large iron wires of the outer covering were broken, as well as the internal copper conductor, yet so tenacious was the gutta-percha, that it resisted the enormous strain, allowing itself to be literally drawn out from the thickness of a piece of maccaroni to an attenuated shred of vermicelli, thus adding another fact to those already established of its indestructibility under water, and its superiority over all other insulating materials for submarine cables.

The Submarine Telegraph Company liberally offered the use of their wires to connect the society's rooms this evening with all the capitals of Europe, but, upon applying to the engineer to make the necessary arrangements, it was found impracticable, without great difficulty and expense, owing to the wires of the company being laid under the roadway in the Strand.

I regret this very much, as I had anticipated repeating an experiment which I witnessed some time since, namely, that of sending a telegram over the longest distance of land, and through the greatest extent of sea that was then possible. The experiment was so wonderful and interesting that it will bear relating, as showing what can be accomplished by the aid of electricity, although it does not refer immediately to the Atlantic cable.

A continuous wire was joined up from London to the island of Corfu, a distance of nearly 2,000 miles, but as the wire had necessarily to be suspended from hundreds of poles, extending over such a great distance, and where, perhaps, at every connection a small amount of electric fluid would escape, the charge would not last out to reach its destination without some additional assistance on the road. It, therefore, becomes necessary in such operations to refresh and invigorate the lighting, as in the old slow time a man would water his horses on the road, or as the Brighton "Age" would, in its then wonderful journeys, "change horses in half a minute."

To provide this assistance, instruments called "relays" were placed at different intervals along the line, the object of which was to receive the nearly exhausted current of electricity, revive it instantaneously with additional strength, and send it on to the next relay, and so on till it arrived at its destination.

In order to fully realise this wonderful achievement, we will trace the progress of a message along the route from London to Corfu.

The transmitting instrument in connection with the battery generating the electricity is set in motion. A flash of electricity is liberated, and wings its way along an insulated wire, under the busy streets of London, and under the now quiet turnpike roads to Dover, then under the surging waves, through the submarine cable, peacefully lying at the bottom of the Channel, to Calais, where it mounts up to land again, traverses the intermediate country to Paris, picks up a relay of electricity charged from a local battery in waiting to revive its now languishing strength, and, re-invigorated, pursues its silent and instantaneous flight through cities and towns without stopping, but every now and then receiving assistance and new life, till it arrives at Turin; thence on to Genoa, from whence with increased power it dashes through the submarine cable, 100 miles in length, to Corsica, rushes over this island in the quickness of a thought, descends again into the sea, across the Straits of Bonifacio to Sardinia, up on land again, through villages and over the Gallura Mountains, where the deadly malaria fever lurks that killed so many men in its construction, to the easternmost point of this island; then again taking a header through another submarine cable lying at the bottom of the deepest part of the Mediterranean to Malta, over its rocky ridges to the other side, from whence it finally flashes through another submarine cable under the sea to its destination, Corfu, doing the whole distance of 2,000 miles in two seconds and-a-half, and passing over, in its transit, some of the highest mountains in Europe, as well as five times descending more than a mile's depth into the ocean.

But the coming back of this mysterious agent is still more wonderful than its guided transit along the wire; for there it has an operator, philosopher, guide, and friend to direct its course; but now it returns home again, not along a conductor supplied by man's ingenuity, but alone through the earth. "The world is all before it where to choose," for after it has reached its destination, and recorded its symbolic mission, it is transmitted down a wire, sunk in the earth for that purpose, to find its mysterious way back to the spot from whence it started, and passes up another wire similarly placed in the ground, again into the presence and power of the operator; for, until it has arrived at home, the electric circuit is not completed, and no signal is given.

Wave after wave of electricity was transmitted, until the whole message of some twenty words had been communicated to the island of Corfu, the transit of the whole occupying three minutes; then a brief interval, and click, click, the serpentine length of paper unwinds itself, containing the reply, which came back in even less time than the message sent.

Having now briefly reviewed the subject of submarine telegraphs generally, and the Atlantic in particular, with some, I trust, pardonable digressions, I shall proceed to sum up my conclusions in as few words as possible.

1. First, then, with respect to the original cable, I cordially acquiesce in the resolutions arrived at by the committee appointed by the Board of Trade, that "the failure of the enterprise was to be attributed to the original design of the cable having been faulty, owing to the absence of experimental data; to the manufacture having been conducted without supervision; and to the cable not having been handled, after manufacture, with sufficient care.

2. That intercommunication between the old and the new world, by means of an Atlantic telegraph, is not more desirable than feasible.

3. That the accidents which befel the first cable arose from causes which there is every reason to believe will not occur again.

4. That the improvements in the process of manufacture of the cable itself, as well as of the insulating medium, have greatly enhanced the value of both, and in the latter case to an extent of 10 to 1, as compared with the insulating medium of 1857.

5. That we are no longer exposed to the mercy of the elements in the matter of laying and paying out the cable, as on the previous occasion, the "Great Eastern" having obviated the serious danger and difficulties hitherto experienced from the pitching of vessels employed in these operations, and by which, through the strain upon the cable, success was rendered highly problematical.

6. That the above conclusions are borne out by the liberal proposals of those eminent and successful cable manufacturers, Messrs. Glass, Elliott, and Co., to which I have before alluded.

7. That recent experiments fully demonstrate the possibility of working a one-wire cable commercially; but that it will be cheaper in the end for the Atlantic Company to lay a cable consisting of, at least, two if not three wires, because there will be such an influx of messages both ways, that, if a one-wire cable only is laid, telegrams will have to wait two or three days before they can be sent. The chances of success would also be greatly enhanced by having more than one wire.

8. That of all the various routes contemplated, that between Ireland and Newfoundland presents advantages superior to any other.

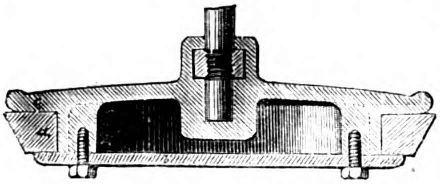
9. That considering the issues at stake, the present state of the science of telegraphy, and the fact that it has already interfered to point out the causes of the former failure, and the remedies to be adopted in any subsequent undertaking, Government might reasonably be called upon for another grant, at all events, to perfect the experiments necessary in a second and successful attempt to lay down the Atlantic telegraph.

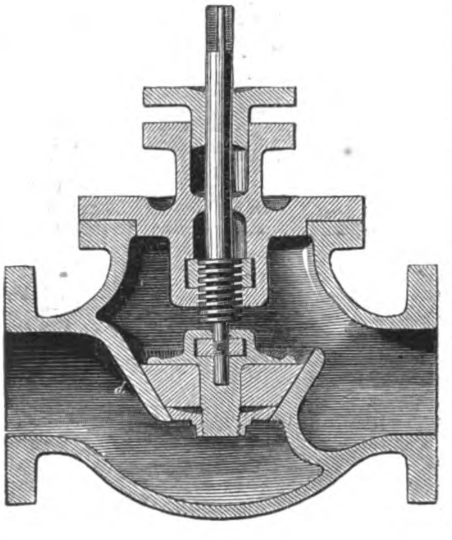
10. That the time has fully come when that attempt should be prosecuted in the interests, not only of science, commerce, and social economy, but also from a regard to the still higher interests of civilization and humanity.

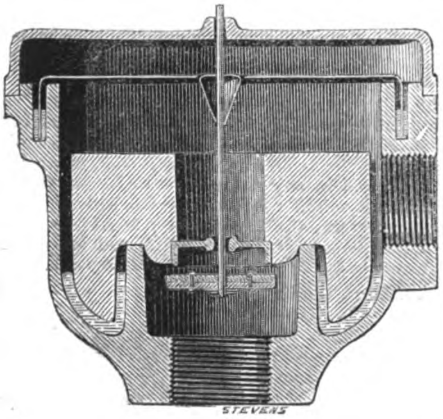
In conclusion, I indulge a fervent hope that those who have sacrificed so much already, and who, nevertheless, are prepared to risk still more to carry out this great work, may in the end reap the full reward of all their noble enterprise. Should, however, that pecuniary reward be wanting, of this I am well assured, that the consciousness of being pioneers on the high road to peace and amity among the nations of the earth, and, above all, between the different families of the great Anglo-Saxon race, will be to them a source of satisfaction, alike deep and permanent. I shall only add the expression of a wish, in which I am certain all here will join, that our kindred across the Atlantic, diverted from scenes of fratricidal strife and bloodshed, may ere long turn their thoughts back again to such subjects as I have been discussing this evening.

Voltaic Batteries for Steamers.—The Emperor of the French is now superintending the construction of one of these batteries, intended to replace fuel. In this country, it has been proposed to our Admiralty to make a trial of a voltaic battery of 2,000 double plates, each containing 30 square inches, the whole surface being 128,066 square inches. Charcoal points, connected with the two poles, are ignited to whiteness; on withdrawing the points from each other, an arch of light, 4 in. in length, is produced between them. When any substance is introduced into this arch, it instantly ignites. Platinum melts as readily as wax in a common candle. Quartz, the sapphire, &c., with equal facility.

TAYLOR'S GAS AND WATER VALVES.





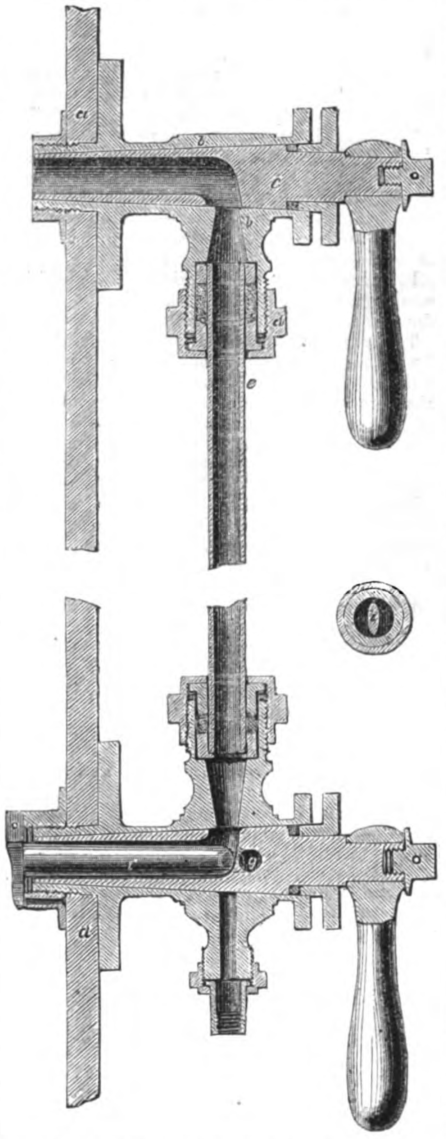


TAYLOR'S PATENT VALVES.

MR. J. W. TAYLOR, of Newsome, York, has patented an invention for improvements in valves, which consist in forming the plugs thereof of india-rubber, such plugs being secured by screw nuts or other suitable means between flanges or washers to the spindle. The accompanying engravings show the invention applied to a tap of the ordinary construction. *a* is the india-rubber plug held between the flanges *b* and *c* ; the plug is formed conical on the outside to fit a seat, *d*, of a corresponding shape, as shewn.

Another part of the improvements relates to apparatus for regulating the pressure and flow of gaseous fluids. The gaseous fluids pass through a chamber having a cover, which is capable of being weighted to the desired pressure, and has a rim projecting downwards into a trough of mercury by which such cover is capable of being lifted without permitting the escape of the gas, as is clearly indicated in the lower figure. The gas passes into this chamber by a passage regulated by a valve suspended from the cover referred to, and this passage is formed in a block with a surrounding edge also dipping into a channel of mercury. By this arrangement of the parts in the event of any derangement they are readily repaired and replaced.

HOWAT'S PATENT WATER GAUGE.



HOWAT'S PATENT WATER GAUGE.

THE annexed engraving illustrates, in sectional view, a water gauge recently patented by Mr. A. Howat, of Farnworth, Lancaster. This invention consists in constructing the plugs of water gauges and blow-off taps with a longitudinal groove or with a scraper, the edges of which, when the plug is turned partly round, scrape and loosen the sediment which may have collected in the body of the tap or in the plug.

a represents a portion of the boiler or other vessel, to which the water gauge is applied ; *b* is the body of the upper tap, which is furnished with a conical plug, *c*, the smaller end of which is towards the boiler, and with a union-joint, *d*, for securing the upper end of the glass tube, *e*, in the usual manner. The body of the lower tap, *f*, is also provided with a conical plug, and with a union-joint, for securing the lower end of the glass tube in the usual manner. The taps are attached to the front of the boiler by nuts as usual ; to the bottom tap a scraper, *i*, is attached, which enters within the plug, as shown in the figure. The upper plug is made with a passage, as shewn, to admit steam from the boiler to the glass tube, *e*, and the lower plug is made with a cross passage, *g*. When the plug is turned one-fourth round, the water out of the glass tube and the steam may be blown off; and when the plug is turned half round, the water alone is blown off through the ordinary passage. Whenever the lower plug is turned partly round, the sediment adhering to the inside of the plug is removed or loosened by the scraper, *i*, and it is blown off with the water or steam. The plugs are ground steam-tight, and are kept in their places by the stuffing boxes.

SELBY'S PATENT SURFACE CONDENSERS.

MR. F. SELBY, of Surbiton, has recently patented a new arrangement of surface condensers, which he describes as follows :—

"I construct surface condensers of a series of chambers, cases, or tubes, each containing within it a coil, or coils, arranged in such a manner that the steam may pass inside the coils or coils, and a separate stream of water entering each chamber, case, or tube (in which a coil or coils are fixed) to condense the steam The coils may be made either of parallel or taper tubing and the coils themselves may be made either parallel or conical. They may be placed round each other by having each successive coil of larger diameter ; or they may be coiled together encircling each other, or in any other convenient manner.

"For small engines one coil and chamber will be sufficient, and although passing the steam inside the coils is believed most efficient and the water outside, yet this may be reversed if desired.

Fig. 1 of the annexed engravings is an elevation partly in section of one of my improved surface condensers composed of one coil fixed in a chamber or tube. Fig. 2 is a plan of the same. Fig. 3 is a sectional elevation of one of my condensers with two coils, one being round or encircling the other placed in the same chamber. Figs. 9 and 10 show in elevation and plan three coils arranged for being inserted in one chamber ; the number of coils may, however, be varied. Fig. 4 is a plan of Fig. 3. Fig. 5 shows an arrangement for connecting coils together. Fig. 6 is an end view. Fig. 7 an elevation, and Fig. 8 a plan showing an arrangement of a series of chambers or tubes, each containing one coil as shown at Fig. 1. The letters refer to similar parts in all the Figures. A A are the chambers or tubes in which the coils are enclosed. B is a bolt or tube for securing the ends D D of the chambers. C C are the coils. E F and G H are chests used when there is a series of chambers A as shewn at Figs. 6, 7, and 8. Although the chambers A are shewn cylindrical, they may be of any other form desired. They may also be employed as framing of engines.

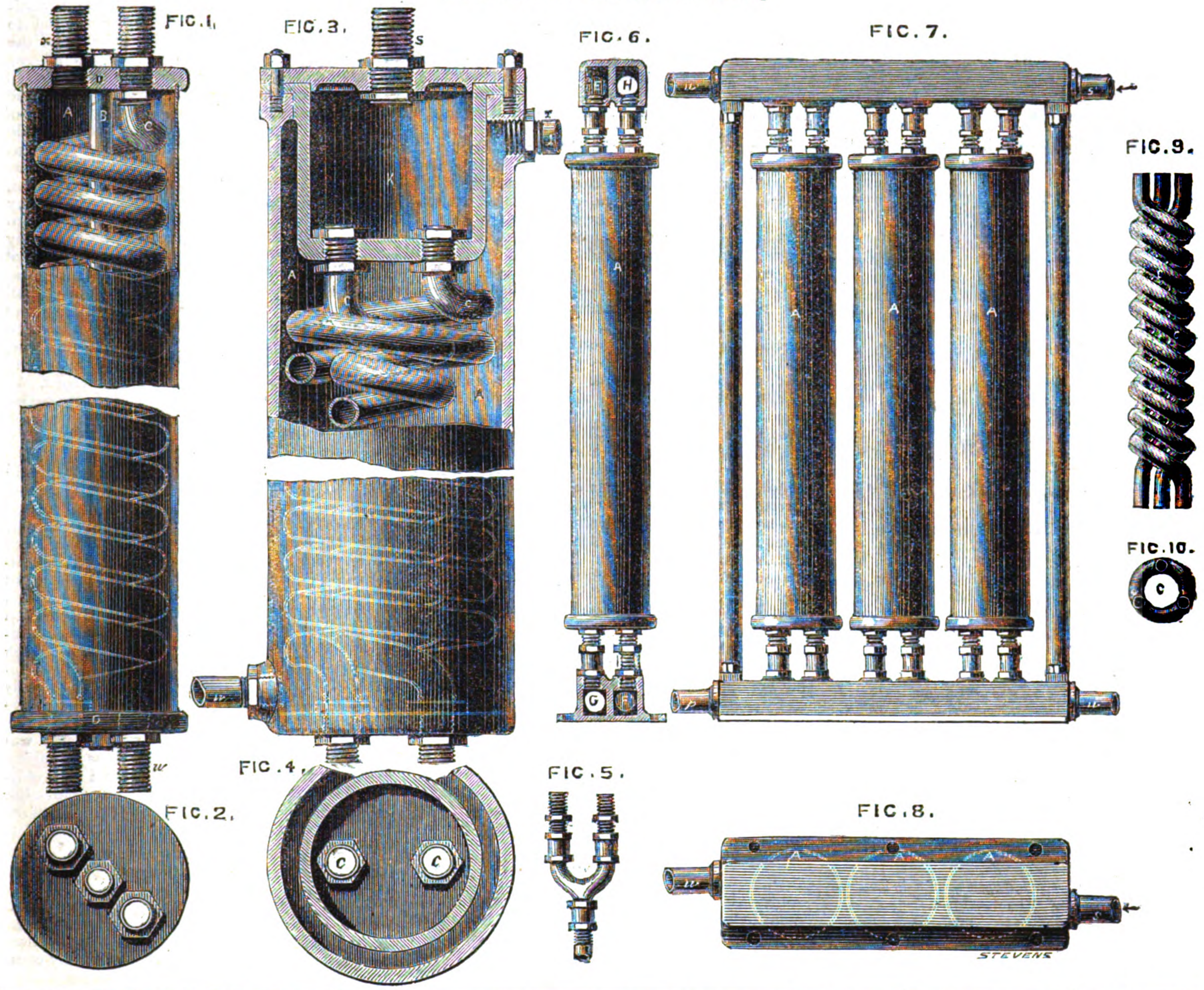
"The action of the condenser is as follows :—If for a small engine, only one chamber and one coil are necessary, as represented at Fig. 1, the exhaust steam from the engine may enter direct into the coil C, wherein it will be condensed, and the resulting water drawn out from the bottom end of the coil. The cooling water enters the chamber A through the pipe *w*, and overflows or is drawn or forced out through the pipe *x*, or *vice versa*.

"In Fig. 3 the exhaust steam enters the pipe *s*, into a chamber K, thence into coils C C, and when condensed flows or is drawn out from the bottom of the coils. The cooling water enters the chamber A as before described with reference to Fig. 1.

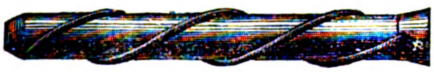
"When series of these chambers, containing a coil or coils, are used, as shown at Figs. 6, 7 and 8, the exhaust steam from the engine enters through the pipe *s* into the chamber or chest E, thence into the coil or coils, where it is condensed, and flows or is forced or drawn into the chest or chamber F, and issues through the pipe *p*. The cooling water enters through the pipe *w* and chest G into the chambers A A A, and is ultimately drawn, forced, or overflows into the chest H, passing out through the pipe *w*.

"Although only water has been mentioned in the description, as a means of cooling or condensing, yet any other medium may be employed if preferred. And the condensers may be used in refrigerating, distilling, and in all cases where air, steam, or gaseous fluids require condensation."

SELBY'S SURFACE CONDENSERS.



WIGZELL'S PATENT SHIP'S BOLT.



The accompanying engraving represents a bolt of a new construction for fastening ship's timbers, the invention of Mr. M. Wigzell, of Topsham, Devon. It consists of a circular formed bolt, or nail, having one or more worms, ribs, or projections, of such a form, and so placed in a spiral direction around its surface, as to cause the bolt, or nail, to revolve whilst being driven into timber after a hole has been made in the timber the size of its solid circular centre, and to hold into the timber with greater tenacity than the plain circular bolts now in use.

INSPECTION OF THE PNEUMATIC DESPATCH BY THE POSTMASTER GENERAL AND SIR ROWLAND HILL.

On Monday last Lord Stanley of Alderley, the Postmaster-General, and Sir Rowland Hill, the Secretary to the Post-office, officially inspected the working arrangements of the branch tube of the pneumatic despatch (which has been laid from the Euston-station to the north western post-office in Eversholt-street), previous to the transmission of the mails between the two places above mentioned, the Post-office authorities having conceded this privilege to the Pneumatic Despatch Company. The time appointed for the inspection was half-past 12 p.m., and on the arrival of the Postmaster-General and Sir Rowland Hill at the station, within the boundary of the Euston terminus, they were received by Sir Charles Rich, one of the directors; Mr. Margary, and Mr. Rammell, the secretary and engineer of the Pneumatic Despatch; Messrs. Blake and Stewart, of the London and North Western Railway, being among those present. The working arrangements were thoroughly explained by Mr. Rammell, the engineer, and trains of cars were rapidly propelled backwards and forwards through the tubes. The cars contained heavy weights, being principally loaded with stout planks, and on the signal being given by Wheatstone's admirable telegraph, they were despatched to the other end of the tube, with a pressure of about 4 ounces, in a few seconds over a minute, the average up the incline being about 1 minute 12 seconds, returning by vacuum in 1 minute 5 seconds. The mail bags, upwards of 120 per day, will be blown through the tube in 55 seconds to the post-office, Eversholt-street, the usual time occupied by the mail carts being at present about ten minutes. Two persons were conveyed, in the presence of the Post-office authorities, through the tube, and returned by vacuum without having experienced the slightest discomfort. Having fully examined the operation of blowing the cars from Euston, the visitors proceeded to the station at the other end of the tube. This is situated underground, beneath the roadway of a small turning leading from Eversholt-street, and is close by the side of the north western district post-office. Here the very interesting operation of sending the cars back to Euston was explained by Mr. Rammell, and two cars having been placed within about a foot of the open tube, a vacuum was created, and they were drawn with a rush into the tube, the small station reverberating with the sound of the receding train. This concluded the experiments of the day, and on leaving, both Lord Stanley and Sir Rowland Hill appeared favourably impressed with the entire working of the system—the Postmaster-General observing that it appeared from the experiments to be very satisfactory and very efficient. Previous to leaving the station at Euston, Lord Stanley descended with Mr. Rammell into the air chamber of the revolving disc, the motive power of which consists of a 15-horse power engine. The next step of the company will be to lay tubes connecting the markets of London with Camden goods station, with a tube to the General Post-office, and Pickford's depot in Gresham-street, and these operations will eventually tend to revolutionise the carrying system of the metropolis, and relieve the crowded state of our principal thoroughfares

THE INVENTORS' INSTITUTE.

Inaugurated 1st May, 1862.
Temporary offices, Mr. Richardson's Chambers, 23, Great George-street, Westminster, S.W.

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At a Meeting of the Council of the above Institute, held on the 29th January, 1863, it was resolved that the following Report be received, adopted, and printed, and that copies of the same be respectfully presented to her Majesty's Commissioners, for enquiring into the working of the laws relating to patents for inventions.

R. Marsden Latham, Hon. Sec.

To the Council of the Inventors' Institute.

My Lords and Gentlemen,

As the Patent Law Committee of this Institute, appointed by you, "To obtain information respecting the patent laws, their practical operation and defects, and for the purpose of suggesting such alterations and improvements as may be found necessary," we beg to report that we have carefully considered, clause by clause, the following Acts of Parliament, relating to letters patent for inventions, viz: 21 James I. cap. 3; 5 and 6 William IV. cap. 62; 5 and 6 William IV. cap. 83; 2 and 3 Victoria, cap. 67; 7 and 8 Victoria, cap. 69; 15 and 16 Victoria, cap. 83 (the Patent Law Amendment Act of 1852); 16 Victoria, cap. 5; 16 and 17 Victoria, cap. 115; and 22 Victoria cap. 13. We have discussed the principles of the present system in their general bearings, and the alterations and improvements we would now recommend, for the most part, may be classified under the four following heads:—

I. The mode of granting patents.
II. The duration of patent rights.
III. The cost of patents.
IV. Legal procedure generally as regards patent right, and particularly as regards infringements of patents—the question of scientific evidence, and the desirability of establishing a patent law tribunal or court for the trial of patent causes.

I.—As to the Granting of Patents.

Practical benefit, we believe, would result both to inventors and to the public from the establishment of an official scientific body of competent and experienced persons acting in conjunction with the Commissioners of Patents for Inventions, to investigate the question of novelty on all applications for patents, and whose duty should be to inform the applicants if their alleged inventions be new or old, leaving each applicant to determine for himself whether, at his own risk, he will take the patent out or not.

But as regards the utility and importance of inventions, it might be productive of great injury to inventors to empower any body of men to consider either of those points. Questions of utility and importance can be safely determined by time and actual trial only, and it has been well observed, that "what may appear simple and trifling in one age, often becomes a great invention in another."

Many important and valuable inventions would undoubtedly have been lost to the public, had the efforts of inventors been arrested in their progress by the condemnatory, but erroneous, opinions by which the inventions were at first assailed—opinions for the most part pronounced by the very men esteemed the most competent to judge. Mankind are always slow to receive new truths, and the history of invention and discovery affords many notable instances of great and valuable inventions having been received, not merely by the ignorant, or the world generally, but by the learned and the great men of science, with derision and mistrust. These views receive almost daily illustration; and facts, such as the incredulity and opposition which retarded the first introduction of gas-lighting, railways, and locomotives—Franklin's discoveries with regard to electricity—Watt's steam-engine—the transmission of messages by means of electricity—the propulsion of vessels by steam, and a host of other inventions, conclusively demonstrate the dangerous fallibility of human judgment when endeavouring to estimate the true character or importance of things previously unknown or little understood.

We are of opinion, that no power to refuse applications for letters patent beyond what is now practically exercised, should be conceded or allowed. The power of refusal is entrusted to official investigators, in a few countries abroad, but our experience of its operation in those countries has been generally unsatisfactory, and we view the system with feelings of unequivocal mistrust. The system does not prevail, moreover, in France, Belgium, or in other nations, whose policy respecting invention is more advanced than that of our own country.

Few inventions can be brought into general use in a less period than three or four years; indeed some inventions are so far in advance of the age, that a life-toil of labour is scarcely sufficient to secure, not merely their adoption, but even the recognition of the scientific truths they involve. In a majority of cases of this kind, official preliminary investigation, followed by any consequent stoppage of patents, would obviously be premature, sufficient time not having been allowed for the proper practical development of the invention, and adverse, erroneous decisions in such cases would inflict, not only serious injury upon the public, but would occasion the ruin of many meritorious inventors, whose means had all been expended in bringing their inventions to perfection.

We would further observe that, in considering the question of novelty, it frequently happens that the only points of difference between a subsequent and a prior invention, are distinctions extremely delicate and minute, which, though seemingly trifling and frivolous, yet constitute, in practice and effect, the all important difference between failure and success. Numerous additional instances can readily be furnished, showing how highly dangerous and impolitic it would be to make an adverse decision, on the part of any preliminary investigators, the ground for refusing a grant of letters patent; but, enough has been stated on the subject for the purposes of this report. We will further remark, however, that no immediate appeal would remove the difficulty in question, it being beyond doubt that no body of men, whether legal, scientific, or otherwise, are equal to the task of pronouncing authoritative and final judgment on the inutility or non importance of all the new and multifarious inventions which are continually being produced by the ablest and most ingenious minds of a country so eminent for its mechanics, engineers, manufacturers, and men of science, as our own.

Still, after mature consideration, we are inclined to believe that many advantages would arise from a well conducted preliminary investigation, if its direct effect were restricted to placing officially on record the opinions of the investigators, touching the novelty of alleged inventions. We, therefore, recommend that a full description of the invention should be submitted to the investigators, previous to the sealing of the patent, whereupon the investigators should at once institute a search; and if they arrive at the conclusion that the alleged invention, either altogether, or in part, is not new, their opinion, with suggestions for any rectification which may seem desirable, should be transmitted to the applicant. If, then, the applicant refuses to comply with the suggestions made, and, moreover, cannot satisfy the investigators that they have misapprehended the subject, for which opportunity shall be given him, the opinions of the investigators should, with the sanction of the law officer, be placed on record; the applicant, however, having the right reserved to move at any future period for the cancelling of the record. An investigation so conducted would in practice occasion the withdrawal of applications for such patents as would not be sustainable at law; for few inventors, on it being distinctly shown to them, that their inventions are not new, would be foolish enough to proceed further in obtaining an obviously bad patent, and thus incur needless additional expense. The public, also, would pay little heed to a patent with a condemnatory official record upon it; and supposing the investigators had not distinctly erred in their judgment any patent of that character, if brought into a court of law, would certainly bring disaster upon the patentee. On the other hand, the investigators feeling that their decisions, even though adverse, were not irremediable, would not be influenced by the doubts which must necessarily arise in their minds when endeavouring to arrive at decisions upon new inventions. The value moreover, of those patents whose novelty was undisputed, would be greatly increased; capital would the more readily be embarked in developing inventions thus approved, and the inventor would be encouraged to prosecute his efforts with that energy and zeal which alone lead to success.

II.—The Duration of Patent Rights.

We strongly recommend that the attention of the Legislature should be called to the comparatively short time for which patents for inventions are granted, and to the injustice thereby occasioned to inventors.

The writer of a book, however frivolous or useless the book may be, can obtain, at the expense of a few shillings, a copyright for 42 years certain; and, regarding all intellectual rights as equal, why should the man who stamps his thoughts upon matter be less liberally dealt with than the owner of a copyright?

A 14 years' patent right is surely a somewhat niggardly encouragement to inventors, since, during so short a period, few inventors are enabled to obtain anything like fair remuneration for the labour and skill required for practically developing and perfecting new inventions. A large outlay of capital, moreover, is usually necessary to bring an invention into general public use, but such an outlay is seldom justifiable, seeing that at the expiration of so short a time any person can step in and reap the benefit of whatever demand the expenditure of capital may have created. Hence, the labours of the poorer class of inventors are often fruitless, and many inventions, which otherwise would have been productive of much good, are never brought before the public. We are aware that some inventions come into general use more speedily than others, but, even in such cases, the term of patent right should not be less than twenty-one years.

We submit that the following resolutions, with reference to the granting of patents and the duration of patent rights, should be carried into practical effect:—

"1. That it is desirable to recommend the official appointment of a board of investigators, before whom all applications for letters patent shall be presented for consideration.

“ 2. That no report or opinion of the proposed official investigators shall prevent any applicant from obtaining a patent when such applicant, nevertheless, persists in applying for the same.

“ 3. That the official investigation shall take place under the control of her Majesty's law officer, not on application for provisional protection, but after notice to proceed.

“ 4. That all patents should be granted for a term of not less than 21 years.

“ 5. That no description of an invention shall be deemed a publication unless such description be found in a place fairly accessible to the public, or unless such description be written or printed in the English language.

“ 6. That the application for a patent must be made as now by the actual inventor, if alive, or by a person duly authorized by him in writing, but if the inventor be dead, the application may be made by his executors or administrators, or by a person duly authorised by them.

“ 7. That an inventor shall be permitted, on due notice given before the expiration of six months, provisional protection, to have his provisional specification returned to him, and it shall not be published.

“ 8. That it is very desirable that all grants of disclaimers and memoranda of alteration should be subject to such regulations as will secure greater consistency of practice.

“ 9. That with regard to the confirmation of letters patent, such an amendment should be enacted that the inventor or introducer of an invention may more readily, and with greater certainty, have his patent confirmed, notwithstanding a limited prior use.

“ 10. That there should be an amendment of the power of extending the term of letters patent.

“11. That it would be desirable, that any person dissatisfied, either with the allowance or refusal as to any disclaimer or memoranda of alteration, should be permitted to appeal to the Lord Chancellor or Privy Council.

“12. That so much of clauses 12 and 13 of the Patent Law Amendment Act of 1852 as refers to the investigation of rival claims should be expunged, and that in lieu thereof the notice should be given to the board of examiners prior to their investigation, who shall report to the law officer referred to in clause 13.

“13. That a patent should embrace all her Majesty's dominions, and such arrangements as would obtain the concurrence of the respective Colonial Governments would be most important.

“ 14. That it is desirable that clause 19 of the Patent Law Amendment Act of 1852 should be expunged.

“ 15. That an acknowldgement or receipt should be given by the Patent Office officials immediately on the recording of documents, or on the payment of fees.”

III.—As to the Cost of Patents.

We submit that the cost of patents should not exceed what is absolutely necessary to defray office expenses.

The high cost of patents renders it quite hopeless for most persons with limited means to seek protection for their inventions, and numerous useful and valuable ideas are, consequently, lost to the public. Many inventors, knowing that they cannot afford the charges exacted, and seeing no fair prospect of being able to pay for a patent, will not allow themselves to be led into a new inquiry, and are thus deterred from carrying on the experiments necessary to practically and beneficially develope their new ideas. Perfected inventions also of great value, which, if publicly made known, would give employment to a great number of hands, are notoriously kept secret, and withheld from public use, owing to the expense of taking out patents; such inventions are all doubly lost, since, if known to the public, they would become the subject of researches which might lead to other very important and beneficial results.

The high cost of patents, moreover, frequently obliges inventors of limited means, when seeking the assistance of capital, to enter into disadvantageous arrangements, and thus many hardships and great injustice are occasioned. We may here observe, also, that the 3rd and 7th year's payments of £50 and £100 fall very heavy on many deserving inventors, who, from sheer inability to pay, are compelled to relinquish valuable patents when just on the eve of realising their hopes of advantage.

Even with regard to the so-called “ frivolous ” and “ useless ” inventions, the present prohibitory charges are most impolitic and injurious in their effects. A “ frivolous ” invention, so-called, may nevertheless, from the extent of the demand, give employment to many idle hands, it may require for its construction many taxable materials, and form an article of export, so as to become profitable to the community; whilst a “ useless ” invention, so-called, will not unfrequently indicate to other inventors, who may succeed better, a want to be supplied, and so lead to the speedy accomplishment of what is desired. An invention, however useless it may seem, may be suggestive of and give rise to other inventions of undoubted practical utility, and it often happens that the first inventor, though stumbling at every step, and himself unable to achieve success, yet opens up a broad path for other inventors who come after him.

The following abstract of receipts and disbursements has been prepared by a member of this committee from the official reports extending from October, 1852, to December, 1861, published by the Commissioners of Patents for Inventions :—

RECEIPTS AND EXPENDITURE OF PATENT OFFICE 9¼ YEARS, OCT. 1852 TO DEC. 1861.

	1852-3.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	Totals.
RECEIPTS.	£	£	£	£	£	£	£	£	£	£
Stamps in lieu of Fees	72,911	53,030	73,583	91,116	83,887	83,581	95,122	108,132	99,979	761,341
Sale of Specifications ...	,,	834	1,236	1,361	1,463	1,371	1,682	1,439	2,051	11,437
	72,911	53,864	74,819	92,477	85,350	84,952	96,804	109,571	102,030	772,778
EXPENDITURE.										
Law Officers' Fees	19,082	7,818	8,197	8,761	8,913	8,235	8,409	8,820	8,965	87,200
Law Officers' Clerks ...	2,634	831	739	777	798	748	750	801	814	8,892
Patent Office, Salaries, &c.	3,757	3,686	4,003	4,314	4,546	4,688	5,562	6,459	6,573	43,588
Current and Incidentals	3,987	3,342	3,962	5,850	7,565	8,742	5,501	5,024	4,153	48,126
Compensation Fund ...	4,663	4,537	4,584	4,584	4,584	4,584	4,584	4,584	4,584	41,288
Stationery	,,	,,	,,	,,	843	1,670	1,285	1,177	2,594	7,569
Rent	355	490	490	490	490	490	490	520	617	4,432
Printing and Lithography	10,831	29,746	20,762	35,185	38,506	25,011	12,918	12,285	13,425	198,669
Paper	1,288	13,052	5,500	5,799	9,161	5,644	2,857	2,419	2,786	48,506
South Kensington Museum	,,	,,	,,	,,	1,966	1,362	1,403	1,134	1,190	7,055
Salaries for do.	,,	,,	,,	,,	375	575	575	517	730	2,772
Index, Mr. Woodcroft.	1,000	,,	,,	,,	,,	,,	,,	,,	,,	1,000
Fitting up Offices	,,	,,	3,503	,,	,,	,,	,,	,,	,,	3,503
Coals	,,	,,	,,	,,	,,	56	60	88	131	335
	47,597	63,502	51,740	65,760	77,747	61,805	44,394	43,828	46,562	502,935
Paid to Revenue account	,,	,,	35,100	16,685	15,275	15,350	17,725	20,195	18,485	138,815

In the foregoing abstract the odd shillings and pence have been omitted for convenience, and the amount is added in one sum in the following statement :—

Total receipts		£772,778
Payments	£502,935	
Add for difference of shillings & pence .	000,006 ——	502,941
		269,837
Deduct revenue fees		138,815
Surplus		£131,022

It appears, therefore, that after defraying all expences from October, 1852, to December, 1861, there remained a balance of £269,837, of which sum, however, £138,815 was paid as revenue fees into the governmental taxation account, leaving still unappropriated a surplus of £131,022. But why a sum of £138,815, levied from inventors in the obtaining of their patents for new inventions, should have been paid into the governmental taxation account, would seem to require explanation, there being no principle of equity or even of sound public policy, on which so objectionable a tax can be defended.

As regards the still unappropriated surplus of £131,022, which will probably be increased by the year 1862, to £170,000, we submit that in common fairness this and any future surplus should be directly applied to some purpose in connection with the encouragement of inventors and the advancement of practical science.

It also appears, from the foregoing abstract, that whilst the annual receipts from inventors now exceed £100,000, the actual expenses of the Government Patent Office fall below £47,000 per annum, whence it is obvious that a great reduction in the cost of patents can be made without injury, even to existing interests.

In the apportionment of the proposed reduced charge, we recommend that the charge for Provisional Protection should be made as small as possible. This unquestionably would be a great boon to the poorer class of inventors, who then could secure their inventions, and would thereby be enabled to treat with capitalists on more equal terms than at present for the means of bringing their inventions into public use.

With reference to the cost of patents we would further observe, that the question, affecting as it does the whole progress of invention in this country, is one of most serious importance, and requires a thorough and liberal revision on the part of the Legislature. Practical and scientific men, conversant with the state of manufactures abroad, are generally agreed that it is only by dint of great exertion, under the most favourable circumstances, that the supremacy of this country in the manufacturing and chemical arts can be maintained. The comparative cheapness of food abroad, the lightness of taxation, and the liberal encouragement afforded to science and its cultivators by foreign Governments, all materially contribute to counterbalance the natural advantages we possess; but *the chief causes which check invention in this country, impede the progress of the industrial arts, and give the advantage to our foreign competitors, are the high cost of obtaining patents for inventions, and the very doubtful protection which our laws extend to them when obtained*, and we would urge upon our Government the paramount necessity which now exists for a greater and more liberal encouragement to invention than has hitherto been practised. We do so in the confident belief that, were the difficulties we have adverted to removed, it might reasonably be hoped that every new idea and every effort of invention and discovery would then be brought before the public and elaborated for the use of man.

The following are the resolutions we have passed with reference to the cost of patents:—

"16. That it is not politic, or right to subject inventors to any other expenses than such as are absolutely necessary to defray the official expenses incurred in securing to them the protection of their inventions.

"17. That it is only reasonable and just that the existing surplus of funds, levied from the inventors since 1851, be directly applied to some public purpose, in connection with the encouragement of inventors and the progress of practical science.

"18. That from the experience obtained by the operation of the new patent law, during the last ten years, it is manifest that the present charges for patents are very much too high, and we consider that the total expense attending the obtaining letters patent should not exceed £25. That this sum should be divided into five sums, of 50s. each, and a sum of £12 10s.—the five sums of 50s. to be payable in lieu of the present five £5 payments, and the sum of £12 10s. to be payable at the end of the 5th year, or in such other manner as the Commissioners of Patents may deem advisable; but the committee recommend that the first payment should be made as small as possible.

"19. That all further payments on existing patents should be reduced to this proposed scale.

"20. That as soon as the time at which the sums should be paid, and the final specification deposited, has arrived, the patentee, if he has not complied with either of these formalities, shall, within 24 hours, be served, by one of the clerks of the Patent Office, with a notice in writing, or forwarded through the Post-office at the address mentioned by the patentee in his petitition or declaration, stating that the time for the accomplishment of the formality in question has elapsed, and that, if within 28 days from the date of the said notice in writing, he has omitted or otherwise failed to comply with the formality in question, his application shall be null and void, or his patent, if he has one, cancelled; whereupon, if within the 28 days, the patentee, or any person acting for him, fulfil the stipulations of the act, and pay to the said clerk an extra fee of 20s., it shall be lawful for the clerk of patents to comply with and fulfil the formalities as if the application had been made at the proper time."

IV. Legal Procedure generally as regards Patent Right, and particularly as regards Infringements of Patents—the Question of Scientific Evidence and the Desirability of Establishing a Patent Law Tribunal or Court for the Trial of Patent Causes.

We are still engaged in considering these very important points, and in obtaining information thereon. A second report will be issued in the course of a few weeks, in which all our views and resolutions on the points in question will be fully set forth.

The following resolutions have been already arrived at:—

"21. That in clause 35 of the Patent Law Amendment Act of 1852, after the words 'the assignment of any letters patent, or of any share or interest therein, any license under letters patent,' the following words be inserted, 'provided the instrument bears under the signature of the patentee the words *to be duly registered*.'

"22. That the following words be added at the end of clause 35 of the Patent Law Amendment Act, 1852, 'provided always, that the parties to any assignment or license shall be estopped from impeaching or impugning the validity of such patent so assigned or licensed.'

"23. That when any objection to the validity of any patent which is, or has been, before a court of law can be removed by the entry of a disclaimer or memorandum of alteration, such court may order the entry of a disclaimer or memorandum of alteration."

We cannot conclude this report without expressing our thanks to Admiral Sir Edward Belcher, Mr. Robert Richardson, Mr. J. J. Aston, Dr. Normandy, Mr. Richard Roberts, Mr. Hume Williams, Dr. Collyer, Mr. Campin, Mr. Fuller, Mr. Jennings, and Mr. Varley, for their unceasing labours as members of this committee, and for the assistance which their great experience has afforded us whilst considering the very difficult questions which it has been our pleasure to discuss.

CROLL'S TREATMENT OF AMMONIACAL LIQUOR OF GAS WORKS.

Mr. A. A. Croll, of Coleman-street, proposes to avoid the inconvenience and annoyance arising from the treatment of ammoniacal liquor of gas-works in the following manner:—

"Steam from a suitable boiler is conveyed into ammoniacal liquor contained in a suitable closed chamber, and the combined vapour and steam resulting are conveyed from the upper part of this chamber into other ammoniacal liquor contained in another closed chamber placed somewhat higher than the preceding, in order that as the ammoniacal liquor in the previous chamber becomes spent it may be supplied from the second, and if desired other number of such ammoniacal chambers may be employed. From the last ammoniacal chamber the vapour resulting, combined with particles of steam, is conveyed into a closed compartment or chamber of a vessel containing acid adapted to the salt of ammonia desired to be obtained. Thus, supposing the salt desired is sulphate of ammonia, then this last chamber will contain sulphuric acid, and it is at its upper part divided into two compartments, one open at the top, the other closed by a cover, and a partition dipping below the surface of the acid liquid therein and below the mouth of the pipe conveying the vapour and steam thereto from the last ammoniacal chamber. Any vapour arising from the closed compartment of this vessel is conveyed into similar acid in another closed chamber used as a reservoir. From the upper part of this last closed chamber the sulphuretted hydrogen liberated is conveyed to the furnace supplying a vitriol chamber.

"By these means economy and the avoidance or great mitigation of the inconvenience and annoyance arising from the treatment of the ammoniacal liquor of gas-works is secured."

OUR DOCKYARD EXPENDITURE.

A blue book has been recently issued containing balance sheets showing the cost of manufacturing articles in the workshops of the several dockyards and steam factories for the year 1860-61. The dockyards and steam factories from which accounts are presented are Deptford, Woolwich, Chatham, Sheerness, Portsmouth, Devonport, Pembroke. Taking the first table, under the head of mast houses, we find that in the year 1860-61, the total debit for these was £110,042 15s. 9¼d. The highest was Portsmouth, £44,051 8s. 4d.; the lowest, Deptford, £178 7s. 3d. Devonport figures for £20,111 10s. 6½d. In boathouses the expenditure is not very large, commencing with £2,239 3s. 6d. at Woolwich, and ranging to £7,172 4s. 3d. at Portsmouth, Devonport coming in for £5,351 19s. 3d. In capstan houses Chatham stands for the highest, £3,782 16s. 8¾d.; Devonport comes next with £3,084 18s. 7d.; Pembroke is the lowest, £521 7s. 5d. In joiners' shops Devonport stands first, £3,976 4s. 7½d.; Deptford is the lowest, £897 4s. 5d. From two of the dockyards, Deptford and Pembroke, no separate accounts were received from the plumbers' shops, and in none of the establishments from which these were sent was the amount large. At Chatham it was £3,976 15s. 11¾d.; at Portsmouth, £53 6s. 11d. The total debit for wheelwrights' shops in all the dockyards was 1,827 5s. 10½d. Four of the dockyards spent £17,081 0s. 10d. in their millwrights' shops; three, Deptford, Woolwich, and Pembroke, send no return. This is the same in the roperies' department; but in Chatham, Sheerness, Portsmouth, and Devonport, £371,671 5s. 0½d. was expended under this head. As in the joiners, here also Devonport takes the lead—£169,281 3s. 0¾d. Chatham stands for about £27,000 less; Portsmouth, £58,648 18s. 10d.; Sheerness about one-fiftieth part of that sum. An extensive business has been done in sail lofts: Portsmouth, £17,260 16s. 9d.; Devonport about £1,100 less; Pembroke the lowest, £66 14s. 2d. For colour lofts the total debit was £2,299 14s. 2¾d. Devonport was the highest; Sheerness the lowest. Sheerness stands first in the rigging-house department, Woolwich the last, the figures varying from £10,822 19s. 5d. to £16,131 5s. 10d. In the lead, paint, metal, and cement mills, the items are unimportant. Coming, then, to blacksmiths' shops, we find returns from only Portsmouth and Devonport; the former £27,689 10s. 4d.; the latter £736 12s. 11½d. The expenditure in the treenail houses was small; Pembroke was the highest; Deptford the lowest; whilst from Portsmouth no account was received. Oarmakers' shops show a total of £6,243 9s. 6½d.; from Deptford, Woolwich, Sheerness, and Pembroke, no returns were sent. For caulkers and pitch heaters the expenditure was £11,379 12s. 4d.; Portsmouth, £5,959 4s. 6d.; Devonport, £2,647 14s. 2d. Passing over the turners' shops, which do not show for much, next is presented "locksmiths', tinmen's, and braziers' shops;" these are somewhat over £2,000, and none of the items are likely to be challenged by the hon. member for Lambeth. The charge for foundries is scarcely what might have been expected—£5,682 4s. 9¾d.; from Deptford, Woolwich, Sheerness, and Portsmouth, there are no returns. For painting in the several dockyards, £5,170 3s. 7¾d. The only condenser's shop is at Portsmouth, where £15,831, 18s. 8d. was expended; here, also, is the only pump house, which goes down for £840 10s. 0¾d. The only dockyard from which a fire-engine account was received was Devonport, where the expenditure was £145 6s. 4d. "Smitheries" is a heavy item, no less than £211,606 18s. 5¼d. being put down for them. Of this, £55,000 was spent at Portsmouth; £49,000 in the north and south smitheries of Devonport; £32,000 at Chatham; £27,000 at Woolwich; £18,000 at Sheerness; £14,000 at Deptford; and £13,000 at Pembroke. In steam-hammer shops, Portsmouth stands for £13,302 16s. 1d.; Devonport, £11,089 12s. 7d.; Deptford, £3,102 9s. 7d. At Portsmouth nearly £7,000 was expended in the iron-foundries, and at Keyham £4,481 14s. 6d. Brass-foundries—Portsmouth, £45,522 12s. 7d.: Keyham, £13,474 12s. 4d. Copper-smiths' shops—Portsmouth, £4,851 19s. 10d.; Keyham, £4,234 17s. Engine smitheries—Portsmouth, £5,850 15s. 4d.; Keyham, £5,659 10s. 3d. Boiler smitheries—Keyham, £5,394 9s. 10d.; Portsmouth, £5,148 8s. 4d. The total expenditure in the dockyards for the year 1860-61 was £1,362,505 3s. 8d.; and in addition to this, under the head of shops in the steam factories, there is £144,881 3s. 4d.

TELEGRAPHIC INTELLIGENCE.

An Electric Telegraph Across the Mersey.—In consequence of the frequent accidents to the submarine cable arising through the fouling by ships' anchors, the cable has been taken up, and at present messengers perform the communications. It is, however, intended to erect on each side of the river two iron pillars of about 240 feet in height, and on these to extend a strong steel wire, to which will be fastened the telegraph wires. The distance across the Mersey, where it is proposed to erect the pillars, is about 1,300 yards. In connection with the proposed alteration, which seems a very feasible one, we understand that there will be a submarine cable laid between the different lightships, outside the port and the shore, which will be of immense service to the mercantile community, as it will accelerate the reporting of vessels off the port, and, in cases of storm, the position of vessels in distress, &c.

Telegraph to India.—The second ordinary general meeting of the proprietors of the Telegraph to India Company was held this week; Sir

Macdonald Stephenson presiding. The report stated that an arrangement for working the Alexandria and Suez line, which it was hoped would enable the shareholders to realise a dividend during the next four years of from 4 to 5 per cent., had been entered into with Messrs. Glass, Elliot, and Co. To complete the communication to Beyrout, Iscanderoon, or Aleppo, the sanction of the Viceroy of Egypt for the construction of a line to El Arisch had been obtained. The board was not competent to construct the line to Beyrout, and it was therefore suggested that this branch should be registered under the act as a new and co-operative company, the shareholders in the parent company to be entitled to their rateable proportion of shares. The report was adopted, and afterwards the following resolution was agreed to:—"That this meeting approves the proposed arrangement for forming a company with a paid up capital of £50,000, for the purpose of making a line of telegraph to connect the company's line with the Constantinople and Persia Gulf line to India (the shares in which are to be offered to the shareholders in this company), in accordance with the proposals of Messrs. Glass, Elliot, and Co."

Universal Private Telegraph Company.—The half-yearly meeting of the Universal Private Telegraph Company was held on Tuesday, at the offices, 448, West Strand; Mr. Alderman Salomons in the chair. The company had now established their system in the metropolis, and a considerable area was traversed by its lines. In Glasgow lines had been established with marked success, extending as far as Greenock, Paisley, Barhead, Busby, Campsie, and the Vale of the Leven, between 20 and 30 miles distant. Operations were also proposed in Dundee and Edinburgh. The company had recently commenced the development of an extended system in and around Manchester, and the whole of the manufacturing districts, where the advantages of private communication were highly appreciated. In Liverpool, Birmingham, Newcastle, and on the banks of the Tyne, extensive works were also proposed. The success attending the operations so far, and the estimation in which the system was held by those adopting it, were such that there was no doubt that a large and increasing business would yearly advance the commercial prospects of the company. The difficulties of introducing long circuits had been overcome, and the future extension of the lines might be regarded as based upon the most perfect system at present available. The financial result of the company's operations to the end of August last showed a net revenue and expenditure sufficient to declare a dividend of five per cent.

PHOTOGENIC GAS.

According to the newspapers, we find that on Saturday last some experiments were made at the offices, in 95, Bishopsgate-street, of Mr. Mongruel's patent cold vapour regenerator, an invention for the production of a brilliant and economic light from ordinary gas or atmospheric air. The Photogenic Light was invented by M. Mongruel in the beginning of 1862, and it is stated to be already adopted in several of the large towns of France, and in many of the largest cafés and establishments of Paris. It was, moreover, reported on by a commission appointed for the purpose by the Société des Sciences Industrielles, Arts, et Belles Lettres of Paris in October last, and the results of their inquiry are thus stated:—1. That there is a guaranteed reduction of 50 per cent. at least in the consumption of gas to give an equal light. 2. Or, with an equal consumption, there is a luminous intensity double or treble that of the primitive light. 3. Whiteness, regularity, and tranquility of the flame, which, softer to the sight, fatigues less in reading or working. 4. Purification of the gas from its pitchy or napthaline atoms, from its ammoniacal vapours, and the sulphurous acids it carries with it from the factory. 5. Consequently, preservation of paintings, varnish, gilding, and delicate colours, which in establishments lighted by gas are so promptly attacked by these mordant agents. 6. Complete absence of odour and smoke. 7. Lastly, real advantages for the consumer, to whom the inventor guarantees, all expenses paid, 25 per cent. of positive economy on his habitual expenses for gas lighting. The experiments of Saturday last were conducted and explained by Mr. Thomas in the most satisfactory manner. The first experiment was made upon the ordinary gas in use in that part of the city. This gas, when passed through the generator containing the liquid used by M. Mongruel, acquired a vastly increased illuminating power, while the flame of the jets was purer, softer, and steadier. But though the light was more intense the expenditure of gas was less, for, tested by a gas-meter and chronometer, the consumption given was in the proportion of 6 to 10, which is equivalent to a saving of 40 per cent. The next and the most interesting experiment was made upon atmospheric air, which, when passed through the apparatus and liquid, burned with a beautiful clear and steady light. Some idea of the brilliancy of this light may be obtained when it is stated that as measured by a photometer one jet of the ignited air gave more illuminating power than four jets of ordinary gas of equal size. As far, therefore, as the experiments of Saturday were concerned, nothing could be more complete and satisfactory. The capacity of being able to obtain light from the atmosphere must prove of immense advantage in those localities where there are not the means of getting it by the ordinary method hitherto employed; and it is stated that M. Mongruel has had more demands than he can attend to from private individuals for the application of his invention in their mansions. Ingenious inventors have been, and are still, occupying themselves with the carburation of gas, since it has long been known that by dissolving carburetted hydrogen vapours in hydrogen gas, the latter requires a treble or quadruple illuminating power. What, however, was wanted, and M. Mongruel appears to have succeeded in inventing, is an apparatus which will produce a constant vapour, always equally rich in carbon, so that the light is at all times the same. In all other apparatus used for the purpose, the generation of the vapours being effected on the mass of the liquid contained therein, the most volatile parts of the liquid naturally first escape, thus impoverishing the remainder, which daily gives less and less light, until the light disappears altogether, while a considerable quantity of the liquid is still left in the apparatus. In M. Mongruel's generator, on the contrary, the mass of the liquid is enclosed hermetically in an upper chamber, whence it descends by a small tube, to form a thin sheet on the bottom of the lower chamber, wherein its vaporisation is effected, and is supplied, drop by drop, only as what has preceded it is consumed.

SCOTTISH SHIPBUILDERS' ASSOCIATION.

December 1, 1862.

James Rodger, Esq., Vice-President, in the Chair.

(Continued from page 60.)

Remarks on the Build and Equipment of Passenger Steam Vessels. By Mr. George Barber, Shipwright Surveyor to the Board of Trade.

At your last meeting a long and interesting discussion took place upon FORECASTLES, and it seemed to be generally admitted that, as far as space is concerned, forecastles are not what they should be. Now, I find that the sailors do not complain so much about want of room; they will put up with the inconvenience of a small place, and with the discomfort of an insufficiently lighted and badly ventilated forecastle, provided it is dry and tight; and, from what I have myself seen, I know that they have often just cause of complaint about leakage. If it be true that water finds its way into the topgallant forecastles of large vessels, through the butts of the deck planks, which yield when the vessel pitches, it is a proof that such forecastles would be better if additionally strengthened in a longitudinal direction; but I believe that a great deal of the leakage complained of might be prevented by adopting the simple method of making a square butt, say of two inches in length, to the fore-end of the foremost deck planks. I know that this *is* done by many builders; they joggle the ends of the planks into an inner waterway, or into each other, and thereby get good wood for caulking and fastening; but many builders do *not* do it; they allow the men to dub the ends of the planks away to a sharp point, and then fit them against the main waterway or covering-board. The saving of time is the object; but it is a slovenly practice, and I defy those who permit it to get either good caulking or good fastening at the ends of the planks, or to prevent the sailors being subjected to the annoyance and discomfort of a leaky forecastle.

I have, on several occasions, been asked to give my opinion upon the rudders of new vessels—whether they are of the proper form and sufficient size? It appears to me that the most efficient form and area of rudder can only be determined by experiment; but if any member here has studied the subject, and is aware of a rule that will admit of general application, I hope he will put us in possession of his information.

I should like to see the practice of fitting rudder-pendants more generally adopted. Since I have been at this port some three or more cases of vessels having twisted or broken their rudder-stocks have come under my observation, and I cannot see why every coasting, as well as foreign-going steamer, should not have the pendants fixed round the stern; nor why, during the winter months especially, the precaution of having them shackled to the back of the rudder should not be taken.

I find that Mr. Hall, in his most valuable paper, read to you on the 3rd March last, directed your attention to masts, rigging, steering-gear, and windlasses. An excellent paper "On Sail-making" has also been read to you; and I will therefore pass on to the subject of Equipments.

I do not think that anything need be said about ANCHORS, as I never hear any complaints made of their inefficiency. The common anchor, the anchors of Brown, Lennox, and Co., and the patent anchors of Trotman, Rodger, and Betteley and Millar, have each their advocates; and as they all do their work well, it is not at all necessary to enter into the question of their respective merits.

It always occurs to me when I see a vessel launched at any of your yards, and "brought up" by her CHAIN CABLES, how necessary it is that before the cables are stowed away in the lockers they should be, I will not say tested—because you will reply that by the very act of launching they have been subjected to a more severe strain than will ever be brought on them again—but that every link should be thoroughly and minutely examined. I have, on more than one occasion, seen one of the cables snapped asunder, and the vessel "brought-up" by the other. A new link is put into the broken length, and the cables are hauled on board and stowed away; but who knows whether the cable which did not break may not have been permanently injured, and may not give way at a time when it will be most needed? I certainly think that after cables have been subjected to such a sudden and severe strain as is brought upon them in launching, every link should be most carefully examined; and I may here state that it has often been to me a matter of surprise that, although in my district there are thirty building yards, from which more than seventy vessels are launched every year, there is not in the whole district—what I am sure would be found a great advantage to this port alone—a public chain-testing machine.

I have never yet been able to get a satisfactory reply to the question, "How ought the end of the chain cable to be secured in the locker?" Some men of experience contend that the end should be secured by a rope-lashing to an eye-bolt or beam at the upper part of the locker, so that, if it should be necessary, the lashing could be immediately cut with an axe; while others, equally experienced, maintain that the proper way is to secure the end to a strong shackle riveted on the keelson or strengthened floor plate.

Then, as to HAWSE-PIPES. How very few vessels have their hawse-pipes fitted in a proper direction! Instead of stiveing downwards, in the direction of the cable when the ship is at anchor, they are more often fitted, for appearance sake, in such a direction that the cable is subjected to almost as severe a nip as if it were led over the edge of an anvil. I should like to see all large foreign-going vessels fitted with two hawse-pipes on each bow, so that, in a case of emergency, there would be no difficulty in getting out a third anchor.

Some trials of patent PUMPS have recently been made at Woolwich, and very excellent results have been obtained; but for steam-ships, which generally are well provided with the means of pumping out the holds, by either the main cr donkey engine, or by the pumps attached to and worked by the steam winches, I think that hand-pumps of the description fitted to the Clyde-built vessels are sufficient. The only objection that I have to them in coasting steamers is that, as they are flush with the deck, they are very liable to be covered over by deck cargo; and, on this account, I prefer those pumps which have a cast-iron chamber, standing 18 or 21 inches above the deck, and which, at both the up and down stroke, discharge a large volume of water through a nozzle cast on the side of the chamber. If in vessels which are divided into several compartments, and which have a corresponding number of pumps, each standard were to be made to fit into any socket, each brake into any standard, and each spear and box into any brake and chamber, there would not then be that confusion, trouble, and loss of time, in rigging the pumps which I have often seen, even though each set of gear may have had, when it was new, a distinguishing number or mark; and although—to use the argument which I hear so often repeated—"the pumps may never be wanted," it would be a good thing if masters would make it a rule to have the pumps rigged at stated periods, so that they may be able to see for themselves whether or not the working parts and leathers are in an efficient condition. When leaden roses are used, they should not be placed directly upon the skin of the ship, as I have often found the plates underneath, and in the wake of them, eaten away by the action of the lead. This could be prevented by securing the roses to a thin seating of teak, which might be jammed between the floors.

With regard to BOATS, I sometimes think that there is need of improvement. Your Clyde-built vessels are noted for their speed and beauty; and it has often occurred to me that in building your small boats you have been endeavouring to attain the same object; for, in some cases, the boats are nearly "all ends and no middle." It cannot be that the saving of material and labour is the object. Now, it is not at all necessary that small boats should have such very fine lines. Speed must give way to buoyancy and stability, and there is no reason why a good carrying boat should not be also a good-looking boat. Then, as to boat-building, undoubtedly the strongest boats are those which are built of two thicknesses of plank, worked in opposite diagonal directions; but I suppose that this mode of construction is too expensive to be generally adopted, even for ship's life-boats, and we must be content with the ordinary carvel or clincher-built boats. I am not by any means an advocate for boats which have to be suspended at davits being made excessively heavy; and if you will give me carefully-selected and well-seasoned material, and good fastening, I will not object to a little lighter scantling. I have seen excellent boats built of yellow pine; but for boats that may have to take the beach, rock-elm, or larch, or mahogany, is preferable, while for vessels going to hot countries it is desirable that the boats should be built of teak. In some new boats that I have examined, I have thought that the planks would have been none the worse if they had been allowed a little longer time for seasoning; and it would be better to clinch the sides of the nails upon roves than to turn them upon the timbers and landings.

The following description of a life-boat is extracted from the Instructions issued by the Emigration Commissioners to the Surveyors appointed under the "Passengers' Act, 1855:"—"The life-boat should be built whale-boat fashion, both ends alike, and the ends, to a limited extent, should be enclosed and made air-tight. It should have a sheer of about three-quarters of an inch to a foot, rising equally from amidships to the stem and stern. It should be fitted along the sides, under the thwarts, with strong metal or gutta-percha air-tight tubes of about 10 in. diameter, diminishing to 7 or 6 in. at the end cases; and of convenient lengths—say about 2 or 3 ft. each—and properly cased in. Life lines should be fixed along the outsides of the boat, and six life-belts for the crew should form part of its equipment." I may mention that the life-boats of some large ocean-going passenger steamers are supplied with a binnacle and compass, fixed under the after-thwart, and I think that this is an arrangement which should be more generally carried out. Two water-breakers, the water in which ought to be frequently changed, should form part of the equipment of every life-boat.

I am often asked about the BUOYANT APPARATUS, and I always say that I prefer strong copper tubes, strapped up firmly under the thwarts and exposed to view, so that it can be seen at any time whether they are perfect or damaged. I object to the practice of boxing up. Sometimes zinc tubes are surrounded by cork and enclosed in canvas bags; but I have found, even in new vessels, that this has not been a buoyant but a sinking apparatus, from the fact of the tubes havin- been cracked or burst by the workman when ramming in the cork; and, even if this should not be the case, it is well known that when a tube is so snugly stowed away out of sight it is not so easily examined, and it may become useless from corrosion before its uselessness is discovered. If I cannot have strong copper tubes, made of from 40 oz. to 60 oz. copper—that is to say, if owners will not pay builders to put copper tubes into the boats—then let me have large, strong, well-painted canvas bags, filled with good dry cork, for it is not such a serious matter to have these opened and the cork renewed, if wet should have found its way amongst it.

It is very seldom that I have to complain of boats' davits being too heavy. If builders would bear in mind that, not only ought the davits to be of sufficient strength to lower the boat and its equipments, but that they ought to be strong enough to lower the boat full of people safely into the water, and that, sometimes, from the surging of the falls, they are subjected to a dangerous jerking or springing motion, I am sure they would have them made of larger diameter. They could then afford to give them a little more length outboard, and thereby allow sufficient clearance to prevent the landings of the boat catching against the rail or gunwale-moulding or rubber on the ships' side. The strength of a davit depends, of course, to some extent upon its form, but I have found, from trial, that boats of the following proportionate dimensions are efficient, and that davits of the diameter corresponding thereto are sufficiently strong:—

Description.	Length over all.	Breadth over all.		Depth from Gunwale to top of Keel.		Contents.		Diameter of Davit.
	Ft.	Ft.	In.	Ft.	In.	Ft.	In.	In.
Life Boat ...	30	8	4	3	4	833	4	5½
" ...	28	7	9	3	0	651	0	5
" ...	26	6	9	2	9	482	7	4½
" ...	24	6	6	2	8	416	0	4
Cutter.........	22	6	3	2	6	343	9	3¾
"	20	6	0	2	4	280	0	3½
"	18	5	9	2	3	232	10	3¼
"	16	5	6	2	1	183	4	3
Dingy.........	14	5	0	2	0	140	0	2¾

If I say anything about the PATENT APPLIANCES FOR LOWERING, it will be to express a wish that the boats to which they are fitted should be got out and lowered even at more frequent periods than when they are finished with only the ordinary tackles. Clifford's is a valuable invention, and the crews would have greater confidence in it if each man of them were to be taught its mode of application by being made to lower the boat with it himself; but it becomes worse than useless if, as I have known to be the case, the nib of the pendant between the friction rollers is allowed to get set so hard and fast that fomentations of hot grease have to be applied before it will move. The disengaging apparatus of Wood and Rogers is very safe and simple, and Gladstone's is even more easy of application, and less liable to get out of order; but I have seen the efficiency of the former destroyed by the pin and lever having been allowed to get rusted up, and when I had a boat lowered that was fitted with Kynaston's patent hooks, one hook performed its office, and let its end of the boat into the water, while the other stuck fast, and, from sheer neglect, the very aim and object of the patentee was defeated. One of the most simple and ingenious methods of freeing a boat from the chocks is that which I believe is nobody's patent, but which has been fitted to some half-dozen vessels at this port. The outer chock or half-chock, is kept in its position against the bottom of the boat by an iron quadrant, which rests upon a trigger bolt at the underside of the beam or skid, and when this trigger bolt is withdrawn, the chock falls down and the boat can be immediately swung out.

In well-disciplined ships I have had the boats, even with the ordinary tackles, got out and lowered in a most efficient and expeditious manner. The good discipline was the secret of the success; and although I am fully sensible of the difficulties attending the organization of a new crew, and of the amount of ordinary work which crews have to perform, I would impress upon the owners and masters who are present the advantage that would be gained by their establishing a rule, the observance of which would in a short time be regarded as a part of the regular duty, that at stated periods or what would be better still, that at unexpected times, at sea and in harbour, the men are to be exercised in getting out the boats, and that the patent appliances and locking-pintles of the davits are to be examined and worked at least once a-week.

(To be continued.)

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to M. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of his good faith.

RECEIVED.—G.F.W., H.B. and B., N.B., E.E.W., Capt N.P.F.A., S.H., R.W., W.A., I.N., G.B. (next week), W.P.M., R. and Son, S.E.

J. B.—Such an article would be acceptable.

H. BENNETT.—There are several modes of obtaining hydrogen gas. The easiest way for you would be to submit iron or zinc filings to dilute sulphuric acid. The hydrogen is evolved from the water, and the oxygen combines with the metal.

T. S.—It is very probable that there is a corrosive galvanic action going on between a brass propeller and the hull of an iron ship.

A MECHANIC.—The invention of the slotting drill has been claimed by a number of engineers. We should be inclined to give the palm to Mr. Richard Roberts.

F. E.—Very probably; an apparatus such as you propose would be appreciated at so small a cost.

L. M. B.—The safest plan is to patent your invention, and you can then get somebody to try it.

T. SMITH (Newcastle.)—No.

Correspondence.

[We do not hold ourselves responsible for the opinion of our Correspondents.]

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THE ATLANTIC TELEGRAPH.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Being extremely interested in the advance of Geographical science, and being tied to my chair and the country with an attack of gout, may I ask that the MECHANICS' MAGAZINE may be the medium by which I may make a few remarks on the paper read by Dr. Wallich at the Geographical Society on the 12th ult., and of which I take your report in the number of the 16th ult. as conveying the substance.

Dr. Wallich proposes that two steamers shall take a line of parallel soundings of 2 miles asunder between Ireland and Newfoundland, each ship sounding every 5 miles so that each sounding shall be 2½ miles apart, and this for the purpose of ascertaining the nature of the bottom in order that a telegraph cable may be so constructed as to meet the requirements of the bed on which it is to lie; and the doctor estimates that this can be done in five or six months, and he says that this line can be kept.

Admirals Elliott and Sir E. Belcher stated that the scheme was both impracticable and useless, and I naturally thought that, with such a decision from such authorities, the learned doctor would have been satisfied; but no, for on reading the report of the paper read by Mr. Massey, at the Society of Arts on the 28th ult, I was surprised to see that the doctor reiterated his assertions that "it could be done, and that, as such a line of soundings was necessary, it ought to be done."

Dr. Wallich has, I know, been to sea; but, perhaps, he was like "Lord Anson, who had been all over the world but never in it;" but the doctor must have seen some little of the difficulty of keeping a ship in position, and how much she went out of her course one way or the other. Is he aware of the value of astronomical observations at sea? How near latitudes and longitudes can be determined by observations of the moon or stars? Does he know that longitudes by chronometers are dependant on latitudes taken some hours before or after? Does he know the value of dead reckoning when these observations cannot be obtained? If he does, can he say that a belt of two miles can be run straight and correctly across the ocean? If he says it can, and he can do it, we old "salts" may shut up, for he can do more than any seaman in the kingdom, or I may say the world. I say it is impossible, and even to do it approximately, I affirm that it would take nearer five or six years to accomplish than as many months.

But we will suppose for the sake of argument that it can be done and is done—and we know the nature of the bottom at every 2½ miles on a 2 mile belt to America—and he has his cable made to lie on it, heavy cable for rock, a lighter kind for mud and so on. The cable shipped, who is to run it along his belt, taking care that each part shall be paid out on its particular bottom—for five miles on either side of his belt may throw all his calculations out? A ship with a cable paying out (unlike the sounding ships) cannot wait for observations, she must proceed, sun or no sun; perhaps the doctor says this can be done.

Dr. Wallich stated that "a sounding of 100 fathoms had been taken by Lieut. Sainthill, R.N., within about 32 miles of one of 3,000 fathoms taken by Captain Dayman." Not having heard of Lieut. Sainthill or his soundings, I referred to the "Navy List," and saw that the lieutenant is one of 1816, and on the reserved list, and that the case stands thus:—Captain Dayman had obtained a sounding of 3,000 fathoms, within 32 miles of one of Lieut. Sainthill of 100 fathoms. There may not be any great distinction between the two modes of expressing the fact, but there is a vast difference.

But with regard to the doctor's belt of soundings, had Admiral Elliott, or Sir Edward Belcher, got up and assured the meeting that all the doctor's foraminifera and diatoms, were nothing but young oysters, there is no doubt but that Dr. Wallich would have thought that, however good seaman the gentleman might be, he knew nothing of Natural History, and he would be right; and if he judged of either of those gentlemen's seamanship by his knowledge of Natural History, he would have but a poor idea of his abilities in his profession. Are we to judge of Dr. Wallich's Natural History by his seamanship? If so, the marker at page 72 of his "North Atlantic Sea Bed," now on my library table, may remain there for the next generation to go on with, and Part II., which we are promised, may go to the trunk-makers for me; but I do happen to know that the doctor is a clever naturalist, and I also do know that the admirals referred to know *their* work and are clever seamen, and navigators; therefore, in their respective specialities, I know how to value their opinion; but it shows to what visionary lengths men will go when they step beyond their own special calling, and I have only to refer to your number of Dec. 5th, and the scheme proposed by the same gentleman, Dr. Wallich, viz., to place moorings with submarine buoys across the Atlantic to support the Telegraph Cable, and I can only say that when the doctor has found his buoy of sufficient size that will not collapse to support four miles (two to each anchor) of mooring cable, and has laid his first *double* pair of moorings, I will then credit his ability to carry his two mile belt of soundings across the Atlantic—and not till then.

And now, Sir, may I add a few lines on the doctor's "North Atlantic Sea Bed." I own to being an officer in the Royal Navy, and I am naturally jealous of the honour and credit of my cloth, and knowing how much the navy has contributed to Natural History Science, and as the doctor had obtained all the specimens on which he founds his work while on board a man-of-war, I naturally looked for some expression to that effect, at first I did not read the whole of the title page, but I see on looking for it that he states that the "Bulldog" was commanded by Sir Leopold M'Clintock, but in his chart the soundings for which he must have taken from Sir Leopold's observations, there is no acknowledgment otherwise than that they are the "Bulldog's," and in the whole work I can see but two references to Sir Leopold, one, where the doctor submitted to him some adaptation of a clam, and the other where he accompanied the captain up a fiord, and the only acknowledgment I can find of any assistance rendered, is that to Mr. Roughton for making him a dredge.

I believe it to have been impossible for the doctor to have been four or five months on board that ship without receiving assistance, and great assistance, from others, and I am only sorry for the sake of Natural History Professors generally, that the doctor has withheld that common courtesy of acknowledging what is justly due to others, for it will make naval men very chary of rendering assistance when even the small meed of thanks is withheld. Let me refer Dr. Wallich to the Preface of Charles Darwin's "Naturalists Journal of the Beagle's Voyage," if he wishes to see what he ought to have done.

I may add that I do not know Dr. Wallich. I have never seen him, so that I have no personal feeling to influence my comments, they are purely professional. I am, &c.,

AN OLD SAILOR.

January 31, 1863.

PHOTO-ZINCOGRAPHY.

SIR,—In the MECHANICS' MAGAZINE of the 23rd of January it is stated that the folio Shakespeare of 1623 is in course of reproduction at the Ordnance Survey office, by permission of the War Department, and at the instance of Howard Staunton, Esq., of the *Illustrated London News*. As this is not the fact, and no one connected with this office has anything to do with the reproduction of that work, I shall feel obliged if you would insert in your next paper this contradiction of the statement which is calculated to mislead the public. It is also stated that no tangible recognition of Mr. Osborne's services, as the independent discoverer of photo-lithographic process, which is very analogous to the process I have named photo-zincography, was ever made by the Government. But the fact is, Mr. Osborne has not only secured a patent for his process in Australia, but has also received a very tangible recognition of his services from the Government of Victoria in a grant of £1,000.

But no one connected with this office has attempted to secure any advantage to himself by taking out a patent, or sought or obtained the slightest pecuniary reward for our discoveries. We are content with the knowledge that the public appreciate our labours, and recognize the efficiency of the department.

I beg to thank you for the complimentary manner in which you have been pleased to notice the work I have recently published on zincography, a second edition of which is now ready for issue, and which contains an account of the modifications in the process necessary to produce prints with gradation of shade or half tone in permanent ink from a photograph of any subject. I enclose you some specimens of prints with half-tone.

I am, &c.,

HENRY JAMES, Col. R.E.

Ordnance Survey Office, Southampton.
February 2, 1863.

A NEW SUBSTANCE AS FOOD.

SIR,—Voltaire, in his "Dictionnaire Philosophique," tells us that a beggar, asking alms in the suburbs of Madrid, a passer by says to him, "Are you not ashamed to follow that infamous employment, as you are able to work?" "Sir," replied the beggar, "I ask your charity, and not your advice." The poor, proud wretch did not consider (which is undoubtedly true) that more charity to the poor may be sometimes shown in giving them good advice than in giving them money. Such advice, when provisions bear so high a price as they do now, is more especially seasonable. Now, sir, all the gums are highly nutritious. A little, frequently dissolved gradually in the mouth, allays thirst and hunger. Soldiers, shut up in a fortress, could be kept alive many weeks with no other sustenance than gum-arabic, or cherry-tree gum. It is a powerful remedy in dropsy, from its affinity for water. In epidemic seasons, and as a preventive against ague, it may be used as an antiseptic, as it defends, or sheathes, the coats of the stomach against malaria. It braces up the nerves and lax-fibres of the corpulent, and reduces obesity. Dissolved in beef tea, the worst cases of debility are soon conquered. I am, &c.,

London, Feb. 4, 1863. JAMES BRUCE.

REPAIRING THE GREAT EASTERN.

SIR,—In my letter to you on this subject on the 10th ult., I remarked that it was "amusing to see the resuscitation of this plan after an unknown existence of 40 years." I have since learned that this identical plan was repeatedly used by Mr. John Maxton, for the Egyptian Government, some fifteen or twenty years since, and is also in constant use by Mr. B. Jensen, at Dantzic.

I am, &c.,

CHAS. F. T. YOUNG, C.E.

7, Duke-street, Adelphi, Feb. 2, 1863.

Meetings for the Week.

MON.—*Royal Geographical Soc.*, 1, "Inundations of the Nile," by Consul S. S. Saunders. 2, Report, by Dr. Baikie, "On the Countries in the neighbourhood of the Niger." 3, "Notes on Madagascar," by Lieut. Oliver, R.A., at 8.30 p.m.

TUES.—*Inst. Civil Engineers*, "On the Sleeper Woods, Madras Railway," "Description of the Drainage of Dundee," by John Fulton, and "Description of Drainage Works of Newport (Monmouthshire), by Mr. A. Williams, Assoc. Inst., C.E., at 8 p.m.
Royal Inst., "On Animal Mechanics," by Prof. Marshall, at 3 p.m.

WED.—*London Inst.*, Conversazione.
Soc. of Arts, "On the Construction of Twin Screw Steam Ships," by Capt. T. E. Symonds, at 8 p.m.

THUR.—*Royal Inst.*, "On Chemical Affinity," by Dr. E. Frankland, F.R.S., at 3 p.m.
Antiquaries, at 8.30 p.m.
Royal Soc., at 8.30 p.m.

FRI. — *London Inst.*, "On the Chemistry of the Non-Metallic Elements," by F. Field, Esq., at 7 p.m.
Royal Inst., "Artificial Illumination," by Dr. E. Frankland, at 8 p.m.
Architectural Assoc., "Class of Design"—"Public Fountain."

SAT. — *Royal Inst.*, "On Life and Death," by W. S. Savory, Esq., at 3 p.m.

Gossip.

On Saturday afternoon an influential meeting was held in Newcastle-on-Tyne, the Mayor in the chair, with the object of forwarding the business connected with the meeting of the British Association in Newcastle, in August next. The nomination of Sir W. J. Armstrong as president; Sir Walter Trevelyan, Mr. N. Wood, Mr. H. Taylor, Mr. I. L. Bell, and Professor Chevalier, as vice-presidents; Captain Noble, Mr. Hunt, and Mr. Clapham, as secretaries; and Mr. Hodgkin, as treasurer, was confirmed. Very influential, local, executive, and general committees were appointed, and it was determined to hold the meeting on the 26th of August. A subscription list was opened at the meeting, and nearly £1,000 was put down.

At a meeting of the Royal National Life-boat Institution, held on Thursday, the 5th inst., at its house, John-street, Adelphi, rewards amounting to £254 15s. 6d. were voted to the crews of its life-boats, and to shore-boats, for rescuing 98 persons from different wrecks during the late fearful gales on the coast. The Institution also voted £1,210 to pay various expenses on its 123 life-boat establishments. The committee earnestly appealed to the public for continued help.

An extraordinary trial has taken place this week between Mr. Clare and the Crown; the trial not having concluded at the time we were making preparations for going to press, we shall offer some observations on the subject next week.

At the meeting of the Mersey Dock Board, on Thursday, last week, a lengthy discussion took place upon the subject of the approaches to the landing stages, so long a crying evil to all who have to cross the river. Ultimately it was resolved that the plan of Mr. Lyster, the dock engineer, should be submitted to the Finance Committee of the Corporation. Mr. Lyster's plan, if carried out, will cost about £500,000.

It was understood that the foot-bridge over the Welland, near the Stamford terra-cotta works, for the convenience of persons having business at the Great Northern Station, would be completed by the 1st. inst. The stone-work has been completed some time, but the iron-work has not yet arrived from the contractors, Messrs. Cliff, of Bradford. We are now informed by Mr. Wright, the engineer, that it was not possible to procure the iron from the rollers for two months after signing the contract, though ordered at the same time, but that in the course of a few days the girders may be expected in Stamford, after which the bridge will be soon completed.

A letter from an officer on board the United States steamer "Bibb," off Charleston, says that Fort Sumter has been plated with railroad iron.

The first train of cars that had ever passed from the State of New York to the State of Ohio, arrived at Warren on the 11th January last, by the Atlantic and Great Western Railway, it being the only line of unbroken gauge between the two States.

A telegram from Constantinople states that the concession, with a guarantee of 8 per cent. on the capital of £1,200,000 for the first section of the Euphrates Railway (from the mouth of the Orontes to Aleppo, 90 miles), has passed the Council of Ministers, and that the firman will issue forthwith.

London Sewage.—A correspondent states that the salts contained in the "bulky fluid" may be solidified by means of plaster of Paris, or a mixture of the same with peat ashes, which contain gypsum. Made into cakes, they would keep a long time without smell; and, when used, should be coarsely powdered, the nitric acid of rain-water being all sufficiently powerful to dissolve any solid manure. London sewage, with its admixture of offal, &c., requires further admixture with a milder substance, like gypsum, which is not only an excellent stimulant to roots and plants to which it adheres, but is a powerful deodorizer. Night soil imparts a biting and acrimonious taste to radishes and turnips. Cabbages are less sapid and delicate. Potatoes borrow its foul taint. It has been traced to the onion. Millers perceive a strong and disagreeable odour in the meal of their wheat grown on it. It imparts a disagreeable flavour to asparagus and tobacco. It seems as if some portion of the foul matter of the night soil is absorbed by the vegetable's *radicles*, and, after passing unassimilated through the sap vessels, is converted, by the process of nutrition, to living substances. Ducks owe their offensive taste, at table, to it.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 1982.
Boilers and Furnaces, 1980.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 1956.
Ships and Boats, including their fittings, 1972, 1995, 2000.
Cultivation of the Soil, including agricultural implements and machines—*none.*
Food and Beverages, including apparatus for preparing food for men and animals, 1941, 1981, 1984, 1987.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 1936, 1946, 1952, 1963, 1996, 1997, 1998, 1999.
Buildings and Building Materials, 1948, 1992.
Lighting, Heating, and Ventilating, 1933, 1934, 1942, 1953, 1955, 1957, 1958, 1970, 1979, 1989.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 1931, 1932, 1938, 1943, 1945, 1949, 1959, 1969, 1971, 1976, 1978, 1983, 1990, 1993.
Metals, including apparatus for their manufacture, 1935, 1947, 1950.
Chemistry and Photography, 1940, 1944, 1962, 1988.
Electrical Apparatus, 1960.
Warfare, 1937, 1966; 1985.
Letter-Press Printing—*none.*
Miscellaneous, 1939, 1951, 1954, 1964, 1965, 1967, 1968, 1973, 1974, 1975, 1977, 1986, 1991, 1994.

1931. J. Murray. *Improvements in portmanteaus.* Dated July 2, 1862.

This consists in fitting and applying the inner hinged flaps that enclose the compartments or divisions of the portmanteau with the hinges or jointed parts at or near the side adjoining the lock, or the fastening of the portmanteau, instead of being near the line of its hinges as usual. *Patent completed.*

1932. J. Steel. *Improvements in water-closets.* Dated July 2, 1362.

In a modification embodying these improvements, the bottom of the basin communicates by a short branch pipe with what may be called the discharge valve box forming the top of the soil pipe. The discharge valve consists of an elastic or flexible material, such as rubber, strengthened at the back; and it is fitted inside the valve box so as to be applied against the opening thereinto of the branch from the basin, this opening being, by preference, fitted with a brass ring projecting slightly inwards to form the valve seat. A kind of plunger is contrived to work up and down in the valve box by a rod passing up through the cover to the usual handle, and this plunger is hooked or jointed to the valve so as to open or shut it, accordingly as it is moved up or down. The plunger is, by preference, guided by means of grooved anti-friction wheels running on guide flanges formed or fitted inside the valve box, and the plunger is also, by preference, fitted with an anti-friction wheel, by which in descending it presses on the valve, and ensures its being completely closed. The valve supply is made self-acting, the supply taps being opened by a lever and float. The float is contained in a compartment provided at the side of the basin, the compartment communicating with the bottom of the basin, or with the branch therefrom, so that, when the discharge valve is opened, the compartment is emptied along with or immediately after the basin, and the float, descending in consequence, opens the supply tap, and the water flows in until the float is again raised by the basin and compartment becoming full. *Patent abandoned.*

1933. J. Crisp and J. W. Elliott. *Improvements in apparatus for burning American oil, paraffin oil, oil of petroleum, and other inflammable oils, spirits, or essences.* Dated July 2, 1862.

The object of these improvements is to obtain security in the burning of American rock oil, paraffin oil, oil of petroleum, and other inflammable oils, spirits, or essences. The material to be burned is placed in a cistern or reservoir through a feed hole, which may be closed by a screw or other plug, having an air hole in it, which, when required, may be protected internally or externally by wire gauze. From this reservoir a pipe conveys the fluid to another tube or chamber, which is closed partially at its lower end by wire gauze, perforated lead, or other suitable substance, and is of size sufficient to receive the wick and burner. For convenience of cleaning the parts of the tubes, the patentees connect them together by screw connections. The passage at the connection of the lower tube with the wick tubes (any part of the lower tube will do) is, by preference, partially closed by having only a very fine perforation or perforations through it of some length, or by the application of a coil of fine wire gauze, or a handle of wires or otherwise, through which the oil is regulated or filtered in its passage to the wick. The part of the tube occupied by the filtering media may be considerably varied to the form or construction of the apparatus. That part of the tube which holds the wick and burners is partially closed at its lower end by some perforated substance, and is made of such a depth as to allow of only a portion of the oil contained in the tubing or apparatus being consumed. By these means the interposition of a column of oil between the flame of the burning oil and the explosive vapour of the reservoir is secured. *Patent completed.*

1934. J. Webster. *Improved apparatus for the manufacture of gas for illumination.* Dated July 2, 1833.

In carrying out this invention for generating gas from solid substances, the patentee finds it convenient to place a worm wheel on the upper end of the axle of the vertical screw, which should be made to fit, or nearly so, the sides of the retort. Into this worm wheel gears a snail or worm, on one end of the axle of which is a crank or winch handle, whereby the worm is rotated, so as to give a slow rotatory motion to the vertical screw for the purpose of carrying down the carbonaceous matters in the retort, which is surrounded by the fire in the fire-place. The upper end of the retort is open, and terminates in a hopper which is supplied with the coal or other carbonaceous material. The lower end of the retort is also open, and terminates in a close chamber below, into which the coke is discharged by the rotation of the screw. The gas, as it is driven off by the heat of the fire, also passes down inte the close chamber below, and is drawn off therefrom into a condensing or cooling apparatus, which consists of a vertical column of suitable height, provided internally with a vertical screw which fits the interior of the column, and therefore divides the capacity of the other into a helically-formed passage, along which the gas is made to pass into a syphon pipe, and from thence through a purifier into a gas holder' *Patent completed.*

1935. G. Bedson. *Improvements in rolling wire and other rods or bars of metal.* Dated July 2, 1862.

This refers to that kind of rolling in which the metal is alternately rolled from one form into another. According to one part of the invention the patentee avoids the necessity for turning the metal by using a series of rollers placed alternately at right angles, or other angle to each other, and so that the metal, as it is delivered from one pair, may be taken up by the next, for which purpose he places guides leading from one pair to the other. Another part of the invention relates to a method of causing the rod to be turned. For this purpose he uses a guide, by which the metal is caused to move in a spiral direction, and so present another face to the next pair of rollers. *Patent completed.*

1936. J. M. Hetherington and T. Jackson. *Improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials.* Dated July 2, 1862.

This relates, 1, To the lubrication of spindles of preparing, spinning, and doubling machines. The spindle turns at its lower end in a footstep, which has a chamber formed around it, provided at its lower end with a hole or holes, through which lubricating material may pass from the said chamber to the spindle. Another part consists in a method of obtaining the "drag" for the ordinary throstle bobbins, which are carried to the spindles, and not by tubes. To effect this drag the patentee uses a plate of metal, which revolves with the bobbin by a pin or other such connection. This plate is bevelled from its outward part towards the centre, and is furnished with a projection extending into the bobbin. *Patent completed.*

1937. T. Turner and W. Taylor. *Certain improvements in single and double breech-loading firearms.* Dated July 3, 1862.

This consists in securing the stock and barrel together, and opening the breech end by a lever secured on the one or both sides of the breech end of the barrel or barrels, having a strap that extends back on the top of the stock to the part that is encompassed by the hand of the user in the act of discharging. The breech end of the barrel or barrels forms the segment of a circle, the radius of which is equal to the centre of the axis on which the lever works, that portion of the lever that abuts against and screens the breech being also of the same radius. On the inside or sides of the lever that encompass the breech of the barrel or barrels (in connection) are dovetailed recesses, and these being formed of the same curvature, of which the axis before referred to forms the centre, great strength is afforded for securing and holding the surfaces for closing the breech end of the barrel in positive contact, and not subject to any variation from expansion of the metal while in use. *Patent abandoned.*

1938. G. H. Birkbeck. *Improvements in the construction of mechanical horses.* (A communication.) Dated July 3, 1862.

The object here is the combination of various parts into a mechanical horse, to enable equestrians to acquire a secure and solid seat, which at the same time is supple and elegant, together with a fine hand. *Patent completed.*

1939. W. A. Gilbee. *An improved manufacture of blue colouring matter.* (A communication.) Dated July 3, 1862.

The patentee claims, 1, The manufacture of blue colouring matter by rosaniline set free, as described. 2, The use of ordinary sulphuric acid of commerce in the hot state to render the blue soluble in water, as described. 3, The use of alkalies to form bluine, and its conversion into salts susceptible of giving a blue colour, as described. 4, The process or means described for obtaining a blue and blue purple colour, applicable for printing or dyeing on silk, wool, cotton, and other materials, by employing water or ordinary nephilated alcohol for dissolving the colours. *Patent completed.*

1910. W. M. Williams. *Improvements in apparatus for the distillation of coal and peat, and such other substances as are or may be used, for the manufacture of solid and liquid volatile hydro-carbon.* Dated July 3, 1862.

The object here is to produce the maximum of liquid hydro-carbons, and also a good coke or charcoal, by conducting the distillatory process in a progressive manner, and consists in certain improvements in the distillatory apparatus by which the gradual heating of the substance under treatment is effected. The products of the distillation at different temperatures may be separated when required, and a good coke or charcoal obtained. *Patent completed.*

1941. T. Edmonds. *Improvements in preparing compressed fruits in cakes.* Dated July 3, 1862.

This consists in the application of a surface of confectioner's wafer material on the top and bottom of such cakes, which may be also applied at other parts of the exterior of such cakes, and which may be embossed, pressed, or otherwise ornamented. *Patent abandoned.*

1942. T. O. Dixon. *Improvements in means or apparatus for heating or warming rooms or buildings with steam, and in carrying off the condensed steam or water therefrom.* Dated July 3, 1832.

This consists, 1, in arranging the steam pipes, or the pipes for conducting and circulating the steam for heating or warming rooms, so as that the condensed steam or water may be drawn off into a receiving pipe at various points in the line or circuit, and be conducted thence to a syphon box or steam trap, steam being also conducted by a separate pipe thereto from the end of the line or circuit, by which arrangement breakage of joints in the pipes is prevented. 2, In the use of an equlibrium valve in combination with a float lever in the syphon box or steam trap, by which the condensed steam or water is carried off, or is permitted to escape without allowing any steam to pass off. *Patent completed.*

1943. J. Miles. *Improvements in machinery for cutting out soles and other parts used in the manufacture of other articles.* Dated July 3, 1862.

Here cutters of the forms of the intended soles are fixed to the under surface of the rising and falling platten of a press, which is put in motion by two connecting rods and two cranks on a shaft driven by hand or other power, there being a fly wheel on the pinion shaft. Two cutters are used, formed to cut the sole for the right and for the left foot respectively. The leather or other material used for forming soles is moved laterally alternately from one cutter to the other, by which waste of material is prevented. The material used for making soles is placed on a bed formed with a surface of lead, wood, &c. where each of the cutters comes, and there are stops or guides to aid in placing the material correctly. An instrument actuated by a cam clears the bed of any bits of the leather that might interfere with or obstruct the action of the cutters at the next cut. The correct height of the bed of the press is regulated by set screws or other convenient means. When other parts of boots or shoes, or parts of other articles are to be cut by the press, other cutters are to be introduced and fixed to the platform in place of those above named. *Patent completed.*

1944. S. Russell. *Improvements in stereoscopes.* Dated July 4, 1832.

Here the inventor makes the stereoscope in the form of a box of a suitable size for holding the pictures, the length of the box being slightly in excess of that of the stereoscopic picture to be used with it, and its depth slightly in excess of the width of the pictures, so that the interior of the instrument is conveniently used as a case to contain pictures, and there is nothing to prevent its being entirely filled with them; the instrument is closed when out of use by a lid sliding in grooves in its two ends or shorter sides. Against the front of the box, and within it, a mirror is fixed, and the lenses or eye-pieces are mounted in apertures in the lower part of the back thereof, and they are inclined so as to be directed nearly towards the horizontal centre line of the mirror. The picture to be viewed is placed in a ledge at the back of the interior of the case, and immediately over and close to the eye-pieces, and it is inclined somewhat so as to bring the reflected picture perpendicular to, or at right angles with, the line of sight, and to accomplish which by this arrangement the picture need not form an angle of more than 16 deg. or 17 deg. with the mirror. The light falls directly on the picture, entering at the open top of the case; and to admit more light to the picture he makes the portion of the front of the case over the mirror, together with a small portion of each of the sides, to turn back on hinges, and this piece, when turned, also serves to support the picture, its upper edge resting against it. *Patent abandoned.*

1945. W. J. Cunningham. *Improvements in sewing machines.* Dated July 4, 1862.

This invention applies to those sewing machines wherein two threads are used, one above and the other below the work, and the invention consists in means (the details of which we cannot here devote space to) for working button and other holes. *Patent oompleted.*

1946. A. Drevell. *Improvements in machinery or apparatus for laying cords or sheets of metal into woven or textile fabrics ready for the press, and also for folding, measuring, or stretching the said fabrics, paper, and other materials.* Dated July 4, 1862.

This invention comprises, first, new arrangements for folding; secondly, new arrangements for feeding forward the cards; thirdly, means for raising the card tables, and, fourthly, the depression of the tissue and cards on the folding table, together with the retention of the said materials at their proper and constant level. *Patent completed.*

1947. S. Whitham. *Improvements in the manufacture of iron and steel, and the apparatus employed for that purpose.* (A communication.) Dated July 4, 1862.

This relates to ball, mill, and puddling furnaces employed in the manufacture of iron and steel, and consists in constructing or building such furnaces in pairs or double, with a stove or chamber formed in the neck thereof, to receive the metal preparatory to its being passed forward into the body of the furnace, and in applying a blast of atmospheric air to such furnaces which may be either hot or cold, as required, whereby the inventor obtains a more uniform heat, producing a better quality of the manufactured metal, with a larger yield; also effecting a saving in fuel and a diminution of manual labour. *Patent abandoned.*

1948. J. Howard and J. Bullough. *Improvements in warping and beaming machines.* Dated July 4, 1862.

This invention (the details of which we cannot produce here) consists in improved modes or arrangements for stopping the warping or beaming machine when one or more of the warp threads break. *Patent completed.*

1949. H. Rushton. *Improvements in covering crinoline steels.* Dated July 5, 1862.

This consists in applying a coating of Japan varnish, or other suitable varnish, upon steel for crinolines, so as to prevent corrosion or rust; and over the steel thus prepared the inventor plaits or weaves cotton, silk, or other fibrous material, so as to make an open work pattern that the varnish may be partially uncovered. *Patent abandoned.*

1950. R. A. Brooman. *An improvement in hollow plates for hydraulic presses.* (A communication.) Dated July 5, 1862.

This invention refers to hollow plates used for receiving a heating medium, and employed in expressing oils and in separating fatty and oily matters from steam in the manufacture of candles, and in similar operations. These plates have hitherto been made in several parts, united by joints and rivets, the result of which has been that fatty and other matters have entered and obstructed the passages within the plates for the circulation of steam or other heating medium, necessitating frequent repairs and cleansing of the plates. Now, this invention consists in making the plates in one piece of malleable cast iron, or of any other suitable metallic alloy, with apertures or channels of any desired shape, round, oval, square, spiral, or otherwise, for the distribution of the heating medium. In some cases the plates are made in top and bottom pieces, which are placed one on the other. *Patent completed.*

1951. O. F. Bystrom. *An improved pyrometer.* Dated July 5, 1862.

This relates to a pyrometer, which the patentee calls the hydropyrometer, from the fact that the temperature of the furnace, retort, muffle, or other heating arrangements to be tested, is indicated by the proportionate amount of heat imparted to a known weight of water by a body immersed therein, such body having been previously heated in the furnace, retort, or muffle to be tested to an equal temperature throughout. *Patent completed.*

1952. C. J. Hill and W. Jackson. *Improvements in machinery or apparatus for producing ornamental patterns or figures, and attaching them to lace or other fabrics.* Dated July 5, 1862.

We cannot here give space to the details of this invention. *Patent completed.*

1953. A. Warner. *Improvements in preparing materials for, and in purifying coal gas.* Dated July 5, 1862.

Here the patentee employs the cinders, or oxide of iron, obtained from puddling, reheating, and refining furnaces used in the manufacture of iron, which cinders or oxide of iron he prepares and uses in place of, or in combination with, other preparations of oxides of iron heretofore employed for like purposes. *Patent completed.*

1954. P. B. O'Neill. *Improvements in screw wrenches or spanners.* Dated July 5, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1955. J. Kidd. *Improvements in gas meters.* Dated July 7, 1862.

This consists in the construction of gas meters for street and other lamps, and burners with one or two measuring chambers, instead of three or more, as meters are made at present, and also in combining with the meter a regulator by which a regular supply of gas is given to the burner at an unvarying pressure. The measuring chamber is placed in the interior of a drum or outer case, and may be worked as an ordinary bellows, or by mercury, as in a mercurial regulator, and is so arranged that, as it takes in and discharges the gas, it gives motion, by levers, to a mercurial level which it causes to turn upon a centre. *Patent completed.*

1956. C. Wersley. *Improvements in carriages.* Dated July 7, 1862.

Here the load and weight of the body of the carriage rests wholly or chiefly upon the nave of the carriage wheels, without bearing upon the axle-tree, viz., cranked axle-tree. This is effected by anti-friction wheels which bear upon the naves of the above-mentioned carriage wheels, and turn concentric around steel trunnions. These trunnions are fixed each in the upper part of a vertical piece of flat iron, the lower end of which encompasses by clutches the vertical parts of the crank axle-tree, so as to follow an up and down sliding of the former. Unto these pieces of flat iron the body of the carriage is attached either by springs, or directly. A knuckle is formed on the piece of flat iron just above the highest point of the axle-tree, so as to form a rest for the whole load upon the axle-tree, in case the trunnion of the anti-friction wheels should give way, and this may move on like common vehicles. *Patent abandoned.*

1957. T. Edwards. *Improved movement for the indices for gas, water, and other fluid meters.* Dated July 7, 1862.

The object here is the construction of a correct and cheap movement for gas, water, and other meters, which will be more easily read off than the indices at present in use, and the accuracy of the several parts may be readily tested by a templet or gauge plate. The improvement consists in substituting for the ordinary toothed wheels, and pinions, now ordinarily used, peculiarly formed wheels, and in casting them upon their shafts or arbours, and in casting or cutting the pinion of the worm motion with a milling tool, that the oblique and curved teeth on the periphery are of equal and uniform depth throughout, and in casting the framework in two pieces, with the holes ready to receive the ends of the shafts on the "arbours" and pillars. *Patent completed.*

1958. J. McGeary. *Improvements in the manufacture of gas, and in the apparatus to be employed for that purpose.* (A communication.) Dated July 7, 1862.

The grant of letters patent for this invention having been opposed at the seal, the document relating thereto cannot at present be seen.

1959. J. P. Booth. *Improvements in the manufacture of beds, quilts, bolsters, and pillows.* Dated July 7, 1862.

Here, in manufacturing feather beds, the inventor lines the tick or cover on its inner face with cotton or other wadding, and secures the wadding thereto by quilting. *Patent abandoned.*

1960. W. Spence. *Improvements in telegraphic apparatus.* (A communication.) Dated July 8, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1962. C. Gunner. *Improvements in photographic apparatus.* Dated July 8, 1862.

This consists in certain novel apparatus whereby the yellow or dark chamber can be entirely dispensed with. *Patent completed.*

1963. J. Brown. *An improved motion for actuating the doffers of carding engines for carding cotton and other fibrous substances.* Dated July 8, 1862.

These improvements are designed with the view to obtain a steady vertical motion of the doffer employed to ship the fibrous substance from the cards, and consists in securing each end of the doffer in a block sliding vertically in a pedestal. These blocks (and consequently the doffer) are actuated in a vertical reciprocating direction by rods or arms, moved by eccentrics placed upon a shaft beneath the pedestals. The peculiar feature of the invention is the use of the sliding blocks and pedestals for the purpose of steadiness. *Patent abandoned.*

1964. J. Russell, jun. *An improved arrangement and method of indication to be employed in railway and other time tables.* Dated July 8, 1862.

This consists in the use and application of stripes, dots, commas, or other marks or signs, to any or all of the division lines now used to separate the rows of figures denoting the time. For example, take the departure of a train consisting of one or two classes of carriages; this is denoted by marks or signs upon the division line, and the numerals usually employed for the purpose are discarded, and, consequently, the space they occupy is saved; then if an extra class is added to the train at a future station, it can be indicated at the point of addition by a mark, when a numeral would only tend to confuse instead of instruct. *Patent abandoned.*

1965. C. Slatford. *Improvements in trimmings, tufts, and other articles for ornamental and decorative purposes.* Dated July 8, 1962.

This invention consists in taking lamb's wool or sheep's wool while still adhering to the skin, and in shaping the skin according to the purpose to which the wool is to be applied, in order to impart the desired shape to the tuft or other article. The wool may be dyed any desired colour or colours, or may be used white. In some cases the inventor unites two or more skins having the wool dyed in different colours. *Patent completed.*

1966. J. Rigby. *Improvements in breech-loading guns, and in cartridges for such guns.* Dated July 8, 1862.

This relates to fitting and furnishing breech-loading guns, which open by moving the barrel out of the line of the breech on a vertical pivot, so that it shall move in the line of the breech until it is free thereof, and then swivel or move on its pivot. The inventor mounts the pivot in an eccentric piece fitted in a bearing in the breech piece, which is extended forward under the barrel for that purpose. On this eccentric is fixed or formed a hand lever, by the movement of which the sliding of the barrel is first effected, and by its continuance the barrel is deflected, and the breech piece exposed for the insertion of the cartridge. Instead of the pivot of the barrel having a rigid bearing in the eccentric, it may be in a slot bearing, and be further guided by longitudinal guides to maintain its parallelism during a certain part of the motion of the eccentric. The second part relates to a method of extracting cartridge cases from breech loading guns. *Patent abandoned.*

1967. O. W. Child. *A new and useful composition to be used in shaft journal boxes.* (A communication.) Dated July 8, 1862.

This composition is composed either of sulphur and plumbago, or the same and stealite, metalic oxides or sulphurets, the whole being capable of being fused, or reduced to a liquid state, and being run or cast into a box or bearing, so as to be used under the journal of a shaft in a similar manner to what is termed "Babbitt" metal is generally employed. *Patent completed.*

1968. J. Bourke. *Improvements in military accoutrements.* Dated July 8, 1862.

We cannot here give space to the details of this invention. *Patent abandoned.*

1969. H. Wethered. *Improvements in the construction of handles, latches, or fastenings for doors, gates, and windows.* Dated July 8, 1862.

This consists principally in the use of a lever handle, on the spindle of which is a tongue or short arm, which can be used single or double, and when brought into a horizontal position may be inserted into a slot or socket made in a catch plate, which is secured by screws or otherwise to the jamb or door-post. When the door is being shut, this tongue or arm of the lever handle is brought against an inclined projecting piece, which will cause the lever handle to assume a horizontal position before the arm or tongue can enter the slot or socket, and the door can be fastened. In order to do this the handle must be lifted up either by the projecting piece on the door or by hand, and the tongue or arm attached thereto must be pushed forward while in a horizontal position into the slot or socket, and when well clear of the projecting piece the lever handle and the tongue or arm on its spindle may be lowered into a vertical position in which it will remain while in a state of rest. *Patent completed.*

1970. W. L. Wigginton. *The cure of smoky chimneys.* Dated July 9, 1862.

This consists in the use of a lining for the sides of fire-places, with back and top, to which is attached a pipe with cap. The principle is this:—The cap will intercept the heat, become very hot, and rarify the air, around which, of course, a partial vacuum into which the denser air of the room will find its way, drawing the hot air before it. Thus, while the cause—the fire—remains, the chimney flue will be efficiently filled with a "flow" volume of hot air. *Patent abandoned.*

1971. J. M. Gille. *An improved calendar inkstand.* Dated July 9, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1972. T. C. Gibson. *Improvements in the construction of ships and vessels for the purpose of carrying and warehousing petroleum, palm oil, and other oils, or inflammable fluids.* Dated July 9, 1862.

This invention consists in building ships or vessels of iron, and of such a shape that the lower part of the hull, or the entire ship or vessel, forms a large tank, or cask, to contain the petroleum, palm oil, or other inflammable substances, either in a fluid or congealed state. In carrying or transporting petroleum, and other oils or fluids, the tank is entirely filled, thus dispensing with the casks now employed for transport. In warehousing petroleum, and other oils or fluids, floating iron vessels, of a cheaper construction than sea-going ships, are employed. These floating vessels should be moored in some convenient place, where the sea-going ship, with her cargo, may go alongside; the petroleum may then be removed by pumps, syphons, or other means, out of the sea-going ships into the floating warehouses. *Patent abandoned.*

1973. A. Gilbey. *Improvements in apparatus for washing and cleansing bottles.* Dated July 9, 1862.

This apparatus consists of a series of brushes, mounted upon a suitable frame, each fixed upon a hollow spindle, which, with the brush, revolves in the inside of a bottle to be cleaned. Through these hollow spindles, and by means of a general supply pipe, with which each one communicates, the patentee introduces a supply of water, which is carried into the inside of each bottle, and, by the action of the brushes revolving, is used to cleanse the inside of it. The bottle is placed slightly inclined from the horizontal plane, the mouth falling into a hollow metal box, through and upon which the hollow spindle is mounted, and, with the brush surrounding it, is passed into the interior of the bottle. The bottom of the bottle is laid upon a sliding seat, so as to regulate its position. The slide is held to its place by means of a spring, so that the bottle is steadied and held in its proper position during the operation. The hollow spindles, with the brushes, are caused to revolve by means of rollers, or pulleys and straps, or by any other well-known motion. When complete, the frame upon which the whole is mounted, is arranged so as to form a trough to receive the dirty water as it comes from the bottles after and during the operation. *Patent completed.*

1974. H. S. Pontifex. *Improvements in apparatus for distributing water, applicable to cleansing casks, or other vessels, and for other purposes.* Dated July 9, 1862.

This invention has for its object improvements in apparatus for distributing water, applicable for cleansing casks, or other vessels, especially that description of casks known as unions, or union cleansing casks, used in breweries, or for other purposes, amongst which may be mentioned extinguishing fires in cellars, or in the holds of ships. In applying the invention to cleansing unions, or union cleansing casks, the patentee is enabled to do away with the apparatus heretofore necessary to cause the casks to revolve when being cleansed, whereby a saving of 25 per cent. is effected in the cost of the construction of such unions, and the water used in cleansing the casks is not one-tenth of the quantity required where the unions revolve. For the purpose of carrying out this invention, he takes a tube of brass, by preference, one end of which is attached by a screw, or by simply tying to a hose-pipe supplied with water in any convenient manner. The other end is formed with a screw on it for a part of its length, for the purpose of carrying a spreader, or valve. Below the screw on the pipe, circular, longitudinal, or other openings, are formed, for the purpose of allowing egress to the water, and the end of the pipe is closed with a plug, which carries a screw on its outer part; on to this screw is fixed an inverted cap, made of copper, brass, or other metal, of larger size than the pipe; the end of the cap comes up to or beyond the screw above referred to, on the body of the pipe, and covers over the holes left in the interior pipe; this cap is curved towards the inner part at its extremity. On to the screw above referred to is placed the spreader, or valve; it is constructed to work on the screw, and has a flat flanged piece fixed to the screw, which is coned, to fit the cone on the cap, and, by screwing down close, can be made to effectually shut the aperture. This screw is fixed on to a pipe of suitable length, which is placed outside the water pipe, and moves freely round it. When working the apparatus, the pipe is dropped a proper depth into the cask, or other place, and, the screw being withdrawn or unscrewed, the water is delivered within the cask, or other place, as required. The adjustment at will of the opening between the cones, by means of the screw, regulates the height and shape of the jet or body of water delivered. *Patent completed.*

1975. J. Rhodes. *Improvements in rag machines.* (A communication.) Dated July 9, 1862.

This invention has for its object the prevention of bits or tufts of untorn-up rags from passing forward with the wool or fibre, and the improvements consist in forming an opening in the cover to the back of the swift, and placing an adjustable slide-plate therein, with a diaphragm or plate betwixt the cover and the swift, which is fixed at one edge to the cover; and, by means of adjusting screws, is set at a suitable distance from the periphery of the swift at the other edge. *Patent completed.*

1976. C. F. W. Rust. *Improvements in concertinas and other wind instruments of that class.* (A communication.) Dated July 9, 1862.

In this newly-invented concertina the notes or keys are arranged in their natural order or succession, as on a pianoforte, viz., C C sharp, D D sharp, E, F F sharp, G G sharp, A A sharp, B, and so on; moreover, the drawing out or pressing in of the instrument produces on the same key one and the same tone. The operation of playing on the instrument is by this arrangement very much simplified, as every tone has its universally known musical place, just where the musical feeling or instinct of the performer would seek it, and the pressing in or drawing out of the instrument need not be taken into consideration at all in playing. *Patent completed.*

1977. H. Eschwege. *Improvements in purifying wood and other vinegar.* Dated July 9, 1862.

The patentee claims the purification of vinegar (acetic acid), in its acid or neutralized state, by filtering the same in a diluted state, as described, through a series of charcoal filters, adding a fresh filter at the end, and disconnecting the first and foulest filter of the series, as explained. *Patent completed.*

1978. G. T. Bousfield. *Improvements in washing machines.* (A communication). Dated July 9, 1862.

In constructing washing machines according to this invention, a barrel or cylindrical wooden vessel is furnished with axes or trunnions, and these are supported by a wooden frame, so that the barrel or vessel is free to revolve end over end. A handle is fixed on one of the axes by which it can conveniently be rotated. At the top of the barrel or vessel a cover is fitted, which is capable of being secured watertight by a cross bar and pressure screw. Within the barrel or vessel a number of circular ribs are fixed against its sides and parallel to its ends. In making use of the machine the fabrics to be washed are placed in the barrel or vessel, together with a number of spheres of wood or stone, and soap and water. The cover is then put on, and secured by the screw and cross bar. The vessel is then rotated for a few minutes, at the end of which time the fabrics will be found completely cleaned. *Patent abandoned.*

1979. E. S. Hindley. *Improvements in apparatus used when circulating hot water for warming dwelling houses and other places, which apparatus may be used for cooling and condensing.* Dated July 9, 1862.

For these purposes, in order to obtain combined arrangements and clusters of tubular passages for the circulation of hot water, a series of tubes or pipes is cast or formed, each tube or pipe having at each of its two ends, or near each of its two ends, a hollow or tubular cross head, communicating with the interior of the tube or pipe of which such cross heads or ends form parts. The two ends of each of these cross heads or ends are made to fit other similar cross heads or ends on other pipes or tubes, so that when several of these cross heads or ends are brought and held together, a continuous tubular passage is produced at both ends of the series of tubes or pipes, and, by preference, at right angles thereto. In order to fix several of such cross heads or ends together securely and watertight, screw bolts are used, which are passed through the tubular cross heads or ends formed at the two ends of the several pipes or tubes. The screw bolts used are of smaller diameter than the interior of the tubular passages in the hollow cross heads or ends, in order that there may be sufficient passage-way for the free flow of water through the hollow cross heads or ends, and to and from them to the tubes or pipes of which the cross heads or ends form parts: or these bolts may be placed outside the said cross heads, and parallel to the direction of those through the cross heads. Between each joint or junction of the several hollow cross heads or ends is introduced a washer or filling piece, of vulcanized india-rubber, or of other suitable soft substance, so that when the nuts on the screw bolts are screwed tightly up to secure the several hollow cross heads or ends, the joints or junctions will be made water-tight. *Patent abandoned.*

1980. T. Green and R. Mathers. *Improvements in steam boilers.* Dated July 9, 1862.

For the purposes of this invention, in order that the steam passing from an upright boiler may be superheated, a tubular passage, arranged in a spiral direction, and in a conical form, is applied above where the tubes or flues come through the boiler from the fire-box, so that the heat and products of the fire as they rise to the chimney may pass against the exterior surfaces of the tubular passage, and highly heat all parts thereof. This will be the better ensured by reason of the coil being, as above stated, in a conical form, and conveniently with the apex or smaller end upwards. The steam coming from the interior of the boiler, by preference, enters the upper end of the highly heated spiral tubular passage, and having passed downwards through the conical arrangement, it passes through the steam-pipe or passage leading from the coil to the cylinder or cylinders, when such cylinder or cylinders are external of the smoke-box; but if the cylinder or cylinders be within the smoke-box then the steam is conducted to the valve-box or boxes of the cylinder or cylinders. In order to increase the heating surfaces of the fire-boxes of steam boilers, the patentees fix bent pipes to the roof or sides of the fire-box. Each bent pipe is formed into two similar limbs, and by preference of malleable cast iron, in order that near the end of each limb there may be a collar to come against the plate of the roof or side when the part which is beyond the collar has been passed through such roof or side plate. The ends of the two limbs are fixed by rivetting or upsetting the part of the tubes which pass through the top roof or side plates. These bent tubes may project into the water space, allowing the heat to circulate through them, or they may project into the fire-box or furnace, so as to be surrounded by the heat, whilst the water circulates through them. In constructing the regulating valves of steam boilers they apply a steam box or chamber on a steam boiler, to which box or chamber the steam supply pipe is fixed. In this box or chamber there is a rising pipe which is closed at the top, the lower end being open and provided with a suitable flange or boss for connecting the outlet pipe. *Patent completed.*

1981. S. V. Evers. *Improvements in the preparation of beverages.* (A communication.) Dated July 9, 1862.

In the preparation of one beverage, according to this invention, the inventor first boils loaf sugar in water, and having mixed the same allows it to cool. He then purifies it by filtration or otherwise, and mixes with it arrack, champagne, and lemon juice. The mixture is first well stirred with iron-stirrers, and then stored in suitable vessels for a certain time, adding to it white of egg. By these means an agreeable and refreshing drink may be obtained. *Patent abandoned.*

1982. J. O. Butler. *Improvements in steam hammers and in framings therefore.* Dated July 9, 1862.

This invention relates to the framing or supporting standards of steam hammers, and consists in making such framing or standards of wrought iron, in lieu of cast iron as heretofore. In some cases the standards may be constructed in one piece of wrought iron, and shaped either by forging under the hammer, or by suitable dies and pressure. For large hammers, the supporting standards would be composed of several wrought iron plates rivetted together, and straightened by angle T, or other suitably shaped bars, as is well known in the making of wrought iron structures. *Patent abandoned.*

1983. W. F. Reynolds. *An improved watch pendant.* Dated July 10, 1862.

This invention consists in passing the ends of the bow through the ball of the pendant, and securing the same by rivetting or otherwise, so as to prevent their return, the said ball being formed in two parts for that purpose, and employed in connection with the fixed pendant, or with a swivel movement and solid bows, the object being to strengthen the bow fastening, and prevent its being forcibly disengaged from the watch, a spring movement being also employed for enabling the bow to maintain its relative position to the watch. *Patent abandoned.*

1984. E. Jandeaux. *Removing the bad flavour from alcohols distilled from grain, beetroot, or other vegetables, and for extracting the whole of the alcohol contained in the fermented juice.* Dated July 10, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1985. H. Kellogg. *Improvements in breech-loading fire-arms and cartridges therefore.* Dated July 10, 1862.

This invention is not described apart from the drawings. *Patent completed.*

1986. J. Mander. *Improvements in crochet needles and crochet needle holders.* Dated July 10, 1862.

This invention consists.—1, In fixing on that end of a crochet needle which is inserted in the holder a small piece of brass, or other material having an expanded end, or making an expanded end on the said needle, which expanded end can be forced into the spring part of the holder, and thereby effect a rapid and safe connection of the needle with its holder. In making a sliding crotchet needle holder according to this invention, the patentee takes a thin metallic open jointed tube or case of the kind used for making small pencil cases, and he connects the needle to the said case by means of a strip of sheet metal, which is bent at its middle into a tubular form. This tubular part grasps the before-described expanded end of the crotchet needle, by means of two or more spring clips situated on its edge. *Patent completed.*

1987. A. Bonnell. *Improvements in churns.* (A communication.) Dated July 10, 1862.

In carrying this invention into practice the patentee makes use of a suitable box or case, mounted on legs, which may be made removable if desired. Within this box or case he places a shaft, with beaters, the said beaters being projecting arms fixed on the shaft in such manner that they shall range as a twisted line or thread of a screw, or an approximation thereto; one end of this shaft comes through the end of the box or case, and has a toothed wheel thereon; the interior of the bottom of the box or case has projecting pieces running the whole length, and forming what may be termed a series of steps. Inside the case, and above these beaters, at the end where the beater shaft protrudes, is a circular case of zinc, or other metal or material, which has a hole at the top, and within side a number of projections or corrugations; and in this circular case is a disc similarly corrugated, which disc has an axis passing through the case, having a toothed wheel outside, this toothed wheel and the toothed wheel first described, being driven by another toothed wheel on a winch handle, such winch handle being provided with arrangements for throwing the same into or out of gear with the one wheel or the other, or causing the whole three wheels to work together. The case has a moveable top, and a plug to clear the churn, and in the top is an orifice communicating with the aforesaid circular case, fitting into which is a moveable feeding dish; into this the cream is poured, and the winch handle being placed in gear with the axle of the circular case only is made to rotate, when the cream will be acted upon by the rotation of the disc therein. The periphery of the disc being some little distance from the inner circumference of the circular case, the cream thus acted on exudes therefrom, and passes into the churn, where the winch handle is thrown out with the disc handle, and into gear with the beater shaft, and again turned; and when the churning is fully effected, it may be cleaned out by pouring in warm water, and placing the winch handle in gear with all the toothed wheels, causing them to rotate, when the hot water can be passed by removing off the plug aforesaid. *Patent completed.*

1988. J. Ponti. *An improved apparatus for viewing photographic pictures, termed an alethoscope, and in the preparation of photographic pictures to be used in such apparatus.* (A communication.) Dated July 10, 1862.

This invention consists in constructing an apparatus for viewing photographic pictures, resembling generally in form that of a stereoscope, but of considerably larger dimensions, and provided with only one large magnifying lens, and only one representation of the picture (which is also of considerably larger dimensions than those employed in stereoscopes). The object of the invention is to present readily to both eyes of the observer, without the inconvenience of looking through two separate lenses, a representation of the picture magnified to such an extent, and at the same time having the stereoscopic effect, sufficiently to impart to the same the appearance of the object itself in its natural size. *Patent abandoned.*

1989. E. J. Biddle. *The use of petroleum or coal oil as fuel, and also for the machinery and apparatus to be employed for this purpose.* Dated July 10, 1862.

The furnace, which may be of any suitable size and shape, is constructed of ordinary materials. Instead of the grate or bars now used, the bed of the furnace is constructed solid to prevent the escape of the fluid. This bed may be made either smooth or corrugated. The draught is obtained through a grating in the side or end of the furnace, which admits the air but confines the flames. And an additional supply of air comes to the flames through pipes terminating within the walls of the furnace. The oil enters the furnace at the bottom, and is at first ignited by surrounding the mouth of the pipe through which it passes with a small quantity of burning coals. A cap may be placed over the furnace for protection in case the flames should escape through the grating. Tanks for holding the oil are provided with pipes, which permit the escape of explosive gases, and render the use of this oil perfectly safe. These tanks are connected with each other and with a distributing reservoir, by pipes of a suitable size. A steam or hand pump may be employed to draw the oil from the tanks to a distributing reservoir. *Patent abandoned.*

1990. E. Townsend. *A new and useful invention for making nails, and driving such nails into the sole of a boot or shoe.* (A communication.) Dated July 10, 1863.

This invention is not described apart from the drawing. *Patent completed.*

1991. J. Leeming. *Improvements in Jacquard, or index, machines.* Dated July 10, 1862.

This consists in a simple and efficient arrangement and combination of the working parts of the Jacquard or index machine, whereby the patentee is enabled to work with either a double or single lift, and also to form a V shed, that is, to lift the back heald a greater height than the front one, and so cause less strain upon the warp threads. *Patent completed.*

1992. D. Steele. *Improvements in the method of flushing or distributing the water in pans, or basins, applicable to waterclosets, urinals, washhand-basins, or other purposes.* Dated July 10, 1863.

Here the inventor manufactures a pan or basin, of any ordinary form, and at or near the top thereof the supply pipe enters; and, as it enters the basin or pan, the aperture is contracted, so as to form a semicircle, containing only about half the area of the supply pipe. The effect of this contraction is to cause the water to be delivered in a suitable way, and at an accelerated speed, into the distributing portion of the pan or basin. The distributing portion is, by preference, formed all in one piece with the pan or basin, or it may be made of china, &c., and affixed to the top of the pan or basin, in any convenient way. This distributor is made of the shape of the inside of the top of the basin or pan, and is of the form of a portion of a pipe, the inner side thereof being cut away, so that there is a narrow space round the pan or basin, between the portion forming the waterway or pipe, and the basin. The water being let into the pan or basin by a valve, tap, &c., fills, or partially so, the tube or pipe, and passes out through the slot or space, between the basin and the pipe, and the stream thus distributed spreads over every portion of the pan or basin. *Patent abandoned.*

1993. J. Farra. *Improvements in wearing apparel called skirts or petticoats and frocks.* Dated July 10, 1863.

This relates to those skirts or petticoats and frocks, in which the lower part is formed by plaits on the fabric, which plaits are usually carried round the circumference horizontally, and consists in forming such plaits diagonally, in regular or irregular folds. Also in forming the plaited part in a piece separate from that above, and attaching it thereto. *Patent abandoned.*

1994. J. H. Johnson. *Improvements in braiding machines.* (A communication.) Dated July 10, 1863.

This relates to peculiar constructions and combinations of parts of braiding machines, whereby they are enabled to work at a greater speed than heretofore, and with greater precision and efficiency. According to this invention, it is proposed to employ a combination of a weight and a spring, for applying the requisite tension, and taking up the slack of the threads in the operation of braiding. This combination may be carried out in various ways. *Patent completed.*

1995. J. R. Hill. *An improved governor for the engines of steam vessels.* Dated July 11, 1863.

This invention is carried into effect as follows:—To the under side of the deck in the engine-room the inventor fixes a suitable frame, from which he suspends a common two-ball governor on pivots, so that it hangs freely, always remaining in a vertical position, uninfluenced by the varying position of the vessel. On the top of the governor-spindle there is a universal joint connecting it with another spindle, the upper end of which works in a bearing fixed to the ship. This latter spindle will be in a permanent position as regards the ship, and receives the motion for driving the governor at the upper end. Both these spindles are hollow, the lower one containing a rod, with flexible joints at the top, for transmitting motion from the balls to the lever of the throttle-valve. *Patent abandoned.*

1996. M. Cornall and E. Griffiths. *Improvements in doubling, twisting, and reeling threads and yarns of cotton and other fibrous materials.* Dated July 11, 1862.

Here the inventors place two or more cops of the thread or yarn to be doubled and twisted on skewers held in discs fixed to a spindle supported in rails or framings. The said spindle has a wharve fixed to it for giving it revolving motion by a band from a revolving drum. The yarns or threads from the cops pass through an eyelet central with the axis of the spindle, and the skewers radiate to the centre of the eyelet, from which the twisted yarns or threads proceed to the reel to be wound upon it, thereby performing the operation of doubling and twisting, and also winding or reeling at the same time. Any suitable number of spindles may be worked simultaneously. *Patent abandoned.*

1997. J. Maithman. *Improvements in machinery or apparatus for carding flax, tow, or other fibrous materials.* Dated July 11, 1862.

This consists in the application to carding engines of revolving rollers constructed of tin plate, or other suitable metal or material, which rollers are placed contiguous to the card rollers or workers, clearers or strippers, and lickers-in, in order to cause the fibres to be more firmly held or retained on the card rollers or workers, clearers or strippers, and lickers-in, thus preventing waste in fibre, and only allowing the dust and refuse to be thrown off. *Patent completed.*

1998. W. Ashton. *Certain improvements in machinery employed in the manufacture of braids and similar articles, parts of which improvements are also applicable to machinery used in spinning fibrous substances.* Dated July 11, 1862.

This relates, 1, To the regulation of the tension of the threads in binding machines, and consists in the use of apparatus in the space beneath the threads. The second part of the invention relates to those portions of braiding machines known as roses or carriers, being a description of toothed wheel, and also to the tubes employed to support the spindles, for which letters patent have been granted to the present patentee, dated the 22nd Feb., 1862 (No. 470), and consists in the application of a particular and peculiar material to the manufacture of such parts not hitherto so employed. A third part consists in the application and use of the aforesaid composition in the manufacture of "top rollers," or other rollers, "saddle hooks," and tubes for steadying spindles in spinning machinery. *Patent completed.*

1999. J. Orr. *Improvements in weaving piled fabrics, and in the machinery or apparatus connected therewith.* Dated July 11, 1862.

The patentee claims, 1, the system or mode of weaving piled fabrics, wherein the forming of the foundation fabric and the adjusting of the fur shoots are effected simultaneously, substantially as described. 2, The arranging of the catcher warps and other parts so that the normal position or position of longer duration of those warps is that of an open shed, substantially, and for the purposes, as described. 3, The introducing of the fur material in either power or hand looms by the improved means described. 4, The working of the catcher warps by an inverted needle frame, and the arranging of other parts in relation thereto to facilitate the introduction of the fur material, substantially as described. *Patent completed.*

2000. J. Miller. *Improvements in apparatus for steering ships and other vessels.* Dated July 11, 1863.

This apparatus consists of two racks, each of which carries a vane or blade, which blades are free to be protruded through the vessel's side on one side or the other by communicating up and down motion throuh a toothed wheel to the racks. The racks are so fitted with respect to the wheel that, while one is raised to bring its vane within the vessel, the other is lowered so as cause its vane to be protruded. The vanes may be set at right angles, or at any other desired angles, with the side of the vessel, and they may be fitted in the dead wood or in any other part of the hull. Instead of racks the vanes may be connected to a band or chain working over a drum or wheel, but the patentee prefers the racks as above described. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Oct. 28, 1862.

2899. J. Fletcher, sen., Leeds, and J. Fletcher, jun., Newcastle-on-Tyne. Improvements in machinery for shaping iron and other metals.

Dated Oct. 31, 1862.

2948. T. Gibson, Berwick-upon-Tweed, watchmaker, T. Hall, Gateshead, gentleman, and T. Davison, broker. Improvements in railway breaks.

Dated Nov. 7, 1862.

3014. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in decorticating grain and seeds. (A communication.)

Dated Dec. 2, 1862.

3229. J. and J. Craven, overlookers, and J. Robinson, manager, Clayton Mill, near Bradford, York. Improvements in looms for weaving.

Dated Dec. 22, 1862.

3418. M. Clark, Glasgow, Turkey red dyer. Improvements in treating waste liquors obtained when dyeing Turkey red colours.

Dated Dec. 23, 1862.

3424. C. A. F. Collette, Giberville, France, lace manufacturer. A new kind of lace.

Dated Dec. 31, 1862.

3698. F. Loret, Mecklin, Belgium, mechanical engineer. Improvements in constructing double weft-forks, applicable to every description of power looms.

Dated Jan. 2, 1863.

21. R. C. Ransome, Ipswich, agricultural engineer. Improvements in reaping machines. (A communication.)

Dated Jan. 7, 1863.

57. T. Storey, manufacturer. Improvements in compound waterproof and ornamental fabrics.

61. T. Aveling, Rochester, engineer. Improvements in the construction of traction engines.

Dated Jan. 8, 1863.

69. C. Allen, Basinghall-street, gentleman. Improvements in apparatus for signalling on railways by detonating or explosive signals.

Dated Jan. 9, 1863.

71. J. Punshon, Pemberton, near Wigan, engineer. Improved means or apparatus for preventing overwinding at collieries, and to provide extra breakage power to steam engines.

73. W. H. Tucker, 6, Southampton-street, Strand. Improvements in locks, and in the modes of connecting the knobs and spindles of the same.

75. C. E. Gray, Great Suffolk-street, Borough. Improvements in wringing machines.

77. M. Cartwright, Islington, engineer. Improvements in alarums for portable and stationary uses.

79. E. T. Hughes, 123, Chancery-lane. Improvements in machinery or apparatus for printing or staining woven fabrics, warps, paper, and other articles. (A communication.)

81. W. H. Moreland and J. Chappell, Loop Bridge Mill, near Belfast. Improvements in winding, warping, beaming, or dressing machines.

Dated Jan. 10, 1863.

85. W. Grove, Tenbury, Worcestershire. An improved apparatus applicable to the sawing and cutting of wood, or other light substances.

87. R. Lüthy, 2, Thavies-inn. Improvements in hydrostatic presses.

90. F. Fenton, Mappleton. Improvements in the manufacture of pulp for paper making and similar purposes.

91. E. Powers, Manchester, chemist, and G. Dale, Warrington, chemist. Improvements in the manufacture of caustic soda and potash, and carbonates, chromates, and stannates of the same alkalis.

Dated Jan. 12, 1863.

93. E. D. Chattaway, 1, New Broad-street, civil engineer. Improvements in railway signals.

97. W. Clark, 53, Chancery-lane, engineer. Improvements in the preparation of green colouring matter. (A communication.)

99. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the application of power designed for stationary and traction engines, propellers, and other machinery. (A communication.)

Dated Jan. 13, 1863.

101. J. B. Fenby, Worcester, gentleman. A new or improved instrument or apparatus to be attached to pianofortes, organs, and other similar keyed musical instruments, for printing the score of any music performed on the said instruments.

103. D. and J. Tannahill, Glasgow, engineers. Improvements in rivet-making machinery.

105. J. T. Stroud, lamp and chandelier manufacturer, Birmingham. Certain improvements in fixed and portable light, for domestic and other uses, applicable for burning gas and the mineral oils or spirits now so commonly used.

107. R. A Brooman, 166, Fleet-street, agent. Improvements in machinery for lifting bobbins off spindles in spinning machines, and in lubricating spindles. (A communication.)

108. W. Southwood, Birmingham, civil engineer. Improvements in machinery for manufacturing nails or brads.

109. M. Tildesley, Willenhall, Stafford, lock manufacturer. Improvements in the manufactnre of padlocks, and other locks and their keys.

111. L. Lescuyer, 2, Carrefour de l'Observatoire, Paris. Improvements in india-rubber overshoes or goloshes.

113. J. B. Rock, Pilton, near Barnstaple. Improvements in apparatus for saving life and property from fire and other danger in buildings and mines.

Dated Jan. 14, 1863.

115. J. Kidd, Cannon-row, Westminster, engineer. Improvements in apparatus for measuring the quantity of gas supplied to single burners, and increasing its illuminating power.

117. J. A. Schlumberger, Bâle, Switzerland, chemist. An improved process for manufacturing colours for dyeing and printing. (A communication.)

121. B. Burrows, Leicester. Improvements in looms used in weaving narrow fabrics.

123. E. Morewood, Stratford. Improvements in the manufacture of coated metallic sheets or plates and pieces, and in apparatus to be used therein.

125. T. Wilkinson, Scarborough, engineer. Improvements in the manufacture of tubular steam boilers.

126. W. Johnson, 166, Buchanan-street, Glasgow, civil engineer. Improvements in the manufacture of chlorine and bleaching powder, carbonate of soda, and soda ash and sulphate of iron. (A communication.)

Dated Jan. 15, 1863.

129. E. Howes, Birmingham, lamp manufacturer. Improvements in railway, ship, and other lamps.

133. G. Graham, manager, and J. M'Leod, Renton, engineer. Improvements in apparatus to be used in Turkey-red dyeing.

135. L. P. Josse, Paris, France, gentleman. An improved apparatus for cleansing wheat or other grain or seeds.

139. J. W. Child, Halifax, engineer. Improvements in means or apparatus employed in spinning and weaving.

141. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in microscopes. (A communication.)

142. D. F. Leblanc, 3, Percy-street, Bedford-square. An improved level indicator or liquid gauge. (A communication.)

143. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in looms or machinery for the manufacture of lace and other fabrics. (A communication.)

Dated Jan. 16, 1863.

145. L. Verdure, Tournai, Belgium, spinner. Improved slubs or rovings (in flax, hemp, and other filamentous materials), produced by the slubbing frame, and destined for fine spinning, as also for improved apparatus employed therein.

147. M. Moeglen, Cernay, France, mechanist. Machinery for printing several colours in succession on the same surface.

148. E. Loysel, Cannon-street, civil engineer. Improved apparatus for preserving valuable property, documents, and letters, in cases of shipwreck.

Dated Jan. 17, 1863.

149. W. Shorrock, Tockholes, near Blackburn, manager. Certain improvements in power-looms for weaving.

151. J. Lightfoot, Accrington, chemist. Improvements in printing and dyeing textile fabrics and yarns.

152. I. Ashe, Birkenhead, bachelor of medicine. Improvements in apparatus for sea-sickness.

153. J. Combe, Leeds, engineer. Improvements in machinery for spreading, drawing, and carding flax and other fibrous substances.

154. G. Haycraft, 23, Lombard-street. Improvements in powder flasks.

Dated Jan. 19, 1863.

157. E. Sabel, Moorgate-street, gentleman. Improvements in the manufacture of artificial stone. (A communication.)

159. J. Laurie, Manchester, agricultural implement maker. Improvements in apparatus for churning milk and mixing liquid compounds.

160. Sir W. O'S. Brooke, 107, Avenue des Champs Elysees, Paris. Improvements in the manufacture of insulators for electric telegraphs.

161. H. Rushton, Northampton-road, Clerkenwell. Improvements in machinery for plaiting cotton, thread, or other fibrous materials over steels for crinolines, and in the mode of securing the plaiting to prevent it slipping thereon.

162. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the manufacture of sulphate of soda for conversion into soda and other uses. (A communication.)

163. W. H. Harrison, Haverfordwest. Improvements in covering wire and other iron articles for the purpose of protecting them from oxidation, and in the mode or method employed therein.

Dated Jan. 20, 1863.

167. J. Mosheimer, Dolgelly, Wales, gentleman. Improvements in machinery for crushing and grinding quartz and other substances.

168. J. Bell, foreman, and J. Speight, fitter, Phœnix Iron Works, Jersey-street, Manchester. Certain improvements in the construction of carding engines.

169. W. Mawson and J. Whitehead, Calverley, near Leeds. Improved hydraulic machinery for raising water in mines, wells, and other places.

170. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. Improvements in the manufacture of clocks. (A communication.)

172. M. Henry, 84, Fleet-street. Improvements in apparatus for retarding and stopping railway carriages. (A communication.)

175. H. Hughes, Homerton, engineer, and J. Sanders, Nottingham, lace manufacturer. Improvements in machinery and apparatus for the manufacture of trimmings and cap fronts.

176. S. Blackwell, 259, Oxford-street, saddler. Improvements in apparatus for applying water or other fluid to the legs and other parts of horses and other animals.

Dated Jan. 21, 1863.

178. A. Phillips, Glasgow, gentleman. Improvements in looms for weaving figured fabrics.

180. F. A. Busch, Briton Ferry, South Wales. Improvements in the manufacture of metallic vessels or receptacles for containing liquids or substances.

182. H. B. Barlow, Manchester. Certain improvements in jacquard machines. (A communication.)

184. A. Boubée, Paris, manufacturer. Improvements in apparatus for casting or moulding articles in glass, and in imitation of precious stones or marbles.

186. W. Clark, 53, Chancery-lane, engineer. Improvements in desiccating and in preserving matters from decay. (A communication.)

190. A. Pennington, 1, Rectory Villas, West Hackney. Improvements in apparatus for beating mats, rugs, and other such like articles.

Dated Jan. 22, 1863.

194. W. Harrison, Blackburn, machine maker, and B. Croasdale, Witton, near Blackburn, overlooker. Certain improvements in looms for weaving.

196. J. Grant, Albion-place, Maidstone, farmer. Improvements in the construction of sidings and loop-lines for railways or tramways, whether portable or otherwise.

200. W. and J. Blackwood, Craigton, bleachers. Improvements in machinery for drying yarns or threads.

202. N. Wood, Hetton Hall, coal owner, and J. Stockley, Newcastle-on-Tyne, engineer. Improvements in apparatus for grinding, smoothing, and polishing plate glass.

204. C. Lungley, Deptford, ship-builder. Improvements in means for facilitating the repairs of ships and other structures.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, Feb: 3.

2588. J. Long. Cleansing and scraping streets.

2595. W. Dobson. Producing various colours on lace.

2596. J. J. N. Micas. Railway brake.

2601. J. Farran. Looms.

2618. W. Lea. Hinges.

2619. A. Potter. Electro-magnetic engines.

2625. J. J. Bates. Window sash fastener and guard.

2629. W. E. Gedge. Construction of leaden window sashes, casements, or glazed coverings on partitions. (A communication).

2635. J. C. P. Bauchard. A twice-transversal kneading trough.

2643. H. Hirsch. Showing combinations of colour.

2647. J. Addison. Moorings or apparatus for securing articles.

2648. R. A. Brooman. Saddle trees and collars.

2649. J. H. Johnson. Shells for war purposes. (A communication.)

2657. P. G. Van der Byl. A power conserver brake for utilizing the power expended in stopping or retarding machinery. (A communication.)

2691. W. Taylor. Preparing fibrous materials.

2694. J. Bradbury. Carding engines.

2695. D. Lowe. Manufacture of door bolts and latches.

2701. A. V. Newton. Apparatus for drying grain. (A communication.)

2703. J. Heap. Screw stocks and dies.

2738. D. S. Sutherland. Constructing beams, girders, bridges, and viaducts.

2849. T. Greenwood. Preparing fibrous substances to be spun.

2870. P. S. Devlan. Manufacture of bearings, steps, axle boxes, and other surfaces and appliances, or articles subjected to friction.

2880. T. G. Ghislin. Treatment and utilization of certain foreign plants.

2997. A. V. Newton. Obtaining printing surfaces. (A communication.)

3151. R. and W. Hawthorn. Pump valves.

3193. W. Clark. Permanent way. (A communication.)

3240. H. Wilde. Magneto-electric telegraphs.

3423. R. A. Brooman. Improved colouring matter or dye. (A communication).

37. H. Bessemer. Construction and mode of working apparatus to be employed in pressing, moulding, shaping, embossing, crushing, shearing, and cutting metallic and other substances.

92. D. Dawson. Manufacturing magenta colour or dye.

114. H. Bessemer. Manufacture and treatment of malleable iron and steel.

119. G. T. Bousfield. Rolling, grinding, and cutting files. (A communication.)

121. B. Burrows. Weaving narrow fabrics.

123. E. Morewood. Coated metallic sheets or plates and pieces.

128. W. Hulse and C. L. Haines. Manufacture of taper metallic tubes.

151. J. Lightfoot. Printing and dyeing fabrics and yarns.

155. G. T. Bousfield. Hot air engines. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Jan. 28, 1863.

2173. C. Bedells.
2181. G. A. Biddell.
2182. J. C. Onions.
2183. R. and D. Nurse.
2184. J. E. Marsh.
2185. C. H. Plevins and H. Rider.
2187. T. G. Webb.
2188. T. Onion.
2190. J. Gray.
2197. J. Higgin.
2202. A. Priestley.
2218. R. W. Ralph.
2232. J. J. H. Gebhardt.
2301. J. Carter and J. Maher.
2398. J. Davis.
2425. J. Mosheimer.
2457. W. E. Newton.
2551. W. E. Newton.
2638. R. Griffiths.
2981. J. Place.

Sealed Jan. 30, 1863.

2194. A. and E. M. Denny.
2198. J. Townsend.
2221. F. M. Jennings.
2283. G. Welch.
2579. P. L. Forestier.
2904. C. S. Duncan.
3250. J. Grant.

Sealed Feb. 3, 1863.

2199. W. Clark.
2203. W. W. Burdon.
2206. W. G. Valentin and F. Levick.
2208. J. H. Johnson.
2212. F. H. M. C. D. C. de F. de Lacombe.
2214. R. A. Brooman.
2215. R. A. Brooman.
2219. E. Hall.
2226. E. Humphreys.
2227. J. Tatham.
2236. G. T. Bousfield.
2247. J. Combe and J. H. Smalpage.
2251. W. Macnab.
2275. L. D. Verstraet and E. M. Olivier.
2317. J. Briere.
2324. W. J. Hoyle and J. Proven.
2347. R. Harrington.
2360. W. E. Newton.
2365. G. Davies.
2371. G. Davies.
2491. G. Ritchie.
2559. W. and J. Todd.
2609. W. Upfill and W. Asbury.
2978. J. McKean and T. Greenhall.
3247. A. F. Eden.
3331. C. Hancock and S. W. Silver.
3337. J. Brown.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

208. R. Sykes and P. Sykes.
206. C. F. Varley.
223. J. H. Johnson.
226. J. Jeffreys.
229. E. Langrn.
238. E. Brooks and H. Waters.
266. M. A. F. Mennons.
242. G. A. Cator.
250. W. E. Newton.
284. T. Blackburn and M. Knowles.
285. R. Adams.
274. T. Routledge.
323. H. C. Jennings.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

255. J. Gretton
390. E. Deiss.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design.
1863.			
Jan. 21,	4534	D. Davies, Shrewsbury…	Carriage Spring.
„ 26,	4535	A. Abraham and Co., Liverpool	"Inman Anomometer."
„ 27,	4536	C. E. Gray, Great Suffolk-street	Clothes Dryer.
		PROVISIONAL REGISTRATIONS.	
„ 8,	1405	T. Rowney, Hull	Ladle.
„ „	1406	J. B. Palmer, Lower Thames-street	Stave for Pails.
„ 12,	1407	W. Weil, Hoxton	Hinge.
„ 14,	1408	R. Newall, Redditch…	Needle Case.
„ 15,	1409	G. K. Leeson, Birmingham	Albert Chain.
„ „	1410	Wakefield, Wyatt, and Co., Bunhill-row	Skirt.
„ 16,	1411	W. Redgrave, New Brompton	Bust.
„ 17,	1412	C. Willson, Birmighm.	Button.
„ 19,	1413	T. Perrott, Kingsbridge	Saddle-tree.
„ „	1414	D. Davies, Shrewsbury	Carriage Spring.
„ 20,	1415	G. Kane, Dublin	Bedstead.
„ 21,	1416	W. Swain, Coventry …	Watch.
„ 22,	1417	C. Caspar, Stockwell…	Porte-monnaie.
„ 24,	1418	H. W. Hart, Fleet-street	Gas Reflectors.
„ 28,	1419	J. Brown, Sheffield	Tube Joint.
„ „	1420	R. Howson and E. F. Jones, Preston	Blast Cylinder.
		E. R. C. Morgan, Swansea	Anchor.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending February 6, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
1735	0 8	1858	1 10	1868	2 2	1878	0 4	1888	0 4	1897	2 0
1849	0 8	1859	1 10	1869	0 10	1879	0 8	1889	1 4	1898	1 0
1850	0 8	1860	0 4	1870	0 4	1880	0 4	1830	1 4	1899	0 4
1851	3 6	1861	0 4	1871	0 8	1881	0 4	1891	0 4	1900	0 6
1852	0 4	1862	0 6	1872	0 4	1882	0 10	1892	0 4	1901	1 4
1853	0 4	1863	0 4	1873	0 4	1883	0 4	1893	0 4	1902	0 4
1854	0 4	1864	0 4	1874	1 4	1884	0 10	1894	0 8	1903	0 4
1855	0 4	1865	0 4	1875	0 4	1885	0 4	1895	0 4	1904	0 4
1856	0 4	1866	0 4	1876	0 10	1887	0 4	1896	0 4		
1857	0 4	1867	1 6	1877	0 10						

12170, 8d.; 12897, 4d.; 12907, 4d.; 1629, 4d.;

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback, 1s.

	£	s.	£	s.
Teak ……load	14	0	15	0
Quebec, red pine	3	10	4	10
„ yellow pine	3	0	4	0
St. John, N.B., yellow	5	0	5	10
Quebec oak, white	5	10	6	10
„ birch	3	0	3	10
„ elm	3	10	5	0
Dantzic, oak	3	10	6	10
„ fir	2	10	3	10
Memel, fir	3	0	3	5
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
„ yellow pine	5	0	6	0
Lathwood, Dantzig, fm.	5	10	6	10
„ St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	19	10
St. John, white spruce	14	10	16	10
Yellow pine, per reduced C.				
Canada, 1st quality	17	0	18	0
„ 2nd do	11	0	12	0
Archangel, yellow	13	0	13	10
St. Petersburg, yellow	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
„ white	9	0	9	10
Gefle, yellow	10	0	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in. „ yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
PUMICE STONE, per ton	5	10	9	0

OILS, &c.

	£	s.	£	s.
Seal, pale ……per tun	48	0	0	0
Sperm body	85	0	86	0
Cod	48	0	0	0
Whale, South Sea, pale	44	0	44	10
Olive, Gallipoli	60	0	0	0
Cocoanut, Cochin	57	0	0	0
Palm, fine	39	10	41	0
Linseed	43	10	0	0
Rapeseed, English pale	55	6	0	0
Cottonseed	34	0	45	0

METALS.

		£	s.	d.		£	s.	d.	d.p.ct.
IRON:									
Welsh Bars, in London	per ton	6	10	0	to	7	0	0	2½
Nail Rods	„	7	5	0	„	7	10	0	„
Hoops	„	8	10	0	„	9	0	0	„
Sheets, single	„	9	10	0	„	9	15	0	„
Staffordshire Bars …	„	7	15	0	„	8	0	0	„
Bars, in Wales	„	5	10	0	„	5	17	6	„
Rails	„	5	15	0	„	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	„	2	14	6	„	2	17	6	„
Swedish Bars	„	11	10	0	„	12	0	0	2½
STEEL:									
Swedish Keg, hammered	„	16	0	0	„	0	0	0	„
„ Faggot	„	17	10	0	„	18	0	0	„
COPPER:									
Sheet and Sheathing, and Bolts	„	96	0	0	„	0	0	0	3
Hammered Bottoms…	„	106	0	0	„	0	0	0	„
Flat Bottoms, not hammered	„	101	0	0	„	0	0	0	„
Tough Cake and Ingot	„	89	0	0	„	0	0	0	„
Tile Copper	„	89	0	0	„	0	0	0	„
Best Selected	„	92	0	0	„	0	0	0	„
Composition Sheathing Nails	per lb.	0	0	10	„	0	0	0	„
Yellow Metal Sheathing and Rods	„	0	0	8½	„	0	0	0	3to7½
Fine Foreign	per ton	0	0	0	„	0	0	0	3
TIN:									
English Block	pr cwt.	115	0	0	„	0	0	0	2½
Bar	„	116	0	0	„	0	0	0	„
Refined	„	120	0	0	„	0	0	0	„
Banca	„	121	0	0	„	0	0	0	nett
Straits	„	120	0	0	„	121	0	0	„
TIN PLATES:									
Best Charcoal, I.C.…	pr box	1	8	6	„	1	9	0	3
Second Quality	„	1	6	6	„	1	7	6	„
Coke	„	1	2	6	„	1	4	0	„
LEAD:									
Pig, English	per ton	21	5	0	„	21	10	0	2½
Spanish, Soft…	„	20	10	0	„	0	0	0	„
Shot, Patent	„	23	15	0	„	24	0	0	„
Sheet	„	21	10	0	„	21	15	0	„
White	„	27	0	0	„	0	0	0	„
SPELTER:									
On the spot	„	18	7	6	„	0	0	0	nett
ZINC:									
English Sheet	„	23	10	0	„	0	0	0	2½
QUICKSILVER	pr btl.	7	0	0	„	0	0	0	3
REGULUS OF ANTIMONY:									
French Star	per ton	42	0	0	„	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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The *Daily News* of May 29th, in its description of Benson's Great Clock, says: "The entire finish is of the highest cast." Benson's new Show Rooms contain clocks designed by the first artists of the day, and include clocks for the drawing room, dining room, bed room, library, hall, staircase, bracket, carriage, church, turret, railways, warehouse, counting house, with musical, astronomical, and every description of clock, from the plainest to the highest quality of which the art is at present capable. Church and turret clocks specially estimated for. Benson's illustrated pamphlet on clocks and watches (free by post for two stamps), contains a short history of clock and watch-making, with descriptions and prices; it acts as a guide in the purchase of a clock or watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world to select a clock. J. W. Benson received a Prize Medal and honourable mention. 33 and 34, Ludgate-hill, London. Established 1749.—[Advt.]

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, FEBRUARY 13, 1863.

THE PETITION OF RIGHT.—CLARE *v.* THE QUEEN.

The recent trial upon a Petition of Right, in the case of Clare *v.* the Queen, assumes importance, because it furnishes the opponents of the principle of granting exclusive rights to inventors with fresh standing ground.

We again hear complaints about the inconvenience of "the system of squatting upon the open heath, where all men ought to be able to range free." And regarding this case as a new instance of the mischievous tendencies of the present system of patents, the *Times* recommends immediate legislation for the purpose of sweeping away the whole system. While we dissent from this view of the case, we certainly are not prepared to establish a complete defence of the new Patent Law. The present case is indeed a striking example of its shortcomings.

The patent in question was granted on the 5th of September, 1853, for "improvements in the construction of iron houses, vessels, &c." If we are to believe the evidence that was given on the part of the Crown, it bears its legal condemnation on its face. Instead of confining himself in the complete specification within the limits described in the provisional, the inventor has introduced a large number of subjects into the former which are not referred to in the latter.

Another of the conditions of patent-right is that the inventor shall communicate fully to the public, not only the nature of his invention, but also its extent and details, so that the public may be able to understand and use it when the patent-right has expired.

But in this case, both the specification and the drawings were so obscure, that the main difficulty in the trial lay in discovering what it was that the petitioner claimed to have invented.

It was contended further, on the part of the Crown, that what appeared to be substantial parts of the petitioner's invention were contained in the previous patents of Dickenson, Guppy, Boydell, and Fairbairn. It was therefore open to the Crown to rest the defence upon any of these grounds, without attempting to prove that the "Warrior" did not contain any of the supposed inventions. But, while evidence was given on all these points, and they were submitted to the jury as distinct questions by the Lord Chief Justice, it was thought better to endeavour to obtain from the jury the more satisfactory verdict that the supposed inventions of Mr. Clare had not been used in the construction of the iron-cased ships of war.

This verdict the jury did not hesitate to give; and they added that, while they were of opinion that the complete specification did contain matters which were not included in the provisional, they desired to be excused from giving answers on the other points, affecting the validity of the patent.

The petition recited five particulars, in which the patent had been infringed by the Crown in the construction of the "Warrior," but during the progress of the case the petitioner's counsel dropped these and adopted two others, which promised to be more defensible. The claim was finally stated by the counsel to be "a combination of vertical and longitudinal framing, and a mode of fastening iron plates to it."

It was alleged, on the part of the petitioner, that previously to 1853 ships had been built without any longitudinal framing, and that whereas the framework should be sufficiently strong to hold firmly together without the aid of the plating; ships, as ordinarily built, would fall to pieces if the plating were taken off. The loss of the "Birkenhead," in 1847, had directed the attention of Mr. Clare to this defect in naval construction. He had carefully studied the matter; and, although not a professional shipbuilder, had devised the mode of remedying the defect, which he had embodied in his patent. This remedy was said to be the introduction of longitudinal frames crossing the ordinary vertical frames.

As it was, of course, undeniable that the "Warrior" had such a system of frames, it was contended on the part of the Crown, first, that the petitioner's specification did not describe or show, as was alleged, any longitudinal and vertical framework, independently of the plates; and, secondly, that if it were shown, it was known and used long before the date of the patent. Notwithstanding the obscurity of the specification, the jury decided that such framework was not described or shown, and it was on this fact that the question mainly turned.

The construction which the patentee seems to us to have described in his specification, is as follows:—He proposes to make all his vertical frames of T-iron, and to place them about eight feet apart. He then introduces a number of horizontal bars between the vertical bars, made either of flat plate or of T-iron, and disposed in rows about three feet apart. These short horizontal pieces are not fastened to the vertical frames until the plates are brought on, when some of the rivets in the plate fastening will pass through and connect the ends of the horizontal bars and the flanges of the vertical bars. Each plate is then made the same length as the interval between the vertical frames, and the same breadth as the distance between the horizontal frames, so that the *joints* of the plates are covered by the horizontal bars, to which they are rivetted by a single row of rivets in each edge, and the *butts* of the plates are covered by the vertical frames to which they are similarly rivetted. Thus, at intervals of eight feet, there is a double row of rivets in the same line from the keel to the gunwale—a system of construction which would prove fatal to any floating structure. In iron shipbuilding, one of the fundamental principles is, that the butts of the plates should not lie in one line, but should be disposed irregularly.

Some seventeen or eighteen years ago, a vessel was built on the Thames, by Mr. Fairbairn, under the patent referred to in this case, which was similar to Mr. Clare's in this respect, that the butts or ends of the plates were disposed in a regular line, supported behind by vertical frames of T-iron. It was found impossible to keep her water-tight, and after being in the possession of the parties for whom she was built about five years, she was sold for less than one-twentieth of the money which she cost.

It will be evident, from what we have said, that the petitioner had no sort of claim for infringement of patent rights, either legally or morally. There is, moreover, reason to believe that he was not ignorant of this. Evidence was given on the trial, that before the patent was taken out he had been advised professionally that the matters it contained were neither new nor useful, and we have good reason to believe that Sir Charles Fox is not the only professional man who has given Mr. Clare wise counsel in this matter. Good advice has, however, been thrown away upon him, and we have to lament that the public time and money should have been wasted in such a vexatious case.

But the petitioner not only claimed compensation for the use of his patents; he sued also for commission as architect for designs and plans furnished by him at the request of the Admiralty. The commission claimed was five per cent. upon the cost of all the iron ships built by the Admiralty. This would amount, as the Attorney-General showed, to at least £100,000 per year, the money already due to Mr. Clare under such an arrangement being £500,000. Mr. Clare considered that, when this was paid, the country would owe him a large debt of gratitude. In support of this part of the case there was not the shadow of evidence. Like many other inventors he had been told by the Admiralty, in answer to his numerous letters directing attention to his inventions, that if he would forward any suggestions with regard to the construction of iron ships, they would be considered. Such suggestions as he sent appear to have been in every case formally rejected. There was no evidence that any design for a ship had been sent in by him under any circumstances; or, indeed, that he was able to make one. Permission was refused him to furnish drawings at the time when the assistance of private shipbuilders was invited by the Admiralty in designing the "Warrior"—assistance which, by the way, was freely given by them and given gratuitously. The Lord Chief Justice said that in the whole course of his experience he had never heard of a claim so wild and so extravagant as this. We have not patience to write more upon this case. Such patentees as this are a social nuisance, of which we trust we shall be able to rid ourselves, while we continue to afford protection to the rights of the legitimate inventor.

WHEEL CUTTING MACHINES.

It is scarcely necessary to urge upon any practical mechanic the great value of a good wheel-cutting machine. It is well-known that this description of special tool was amongst the first machines that made their appearance in English engineers workshops. Messrs. Fox, of Derby, appear to have been the originators in England of an engineer's tool for cutting and dividing the teeth of wheels. Brass wheels—and wooden wheel patterns of a smaller diameter than six inches, and of fine pitches, have their rims generally cast to the depth of their teeth, which are divided and cut out of the casting by the machine. Circular, or rose-cutters, are often formed in the same way.

If a cast-iron toothed wheel be cast perfectly true, it is, of course, better to leave it untrimmed. To take the skin off a casting always reduces its strength, but it also diminishes the duration of the teeth of a wheel. The skin on a casting is somewhat like the skin produced by case hardening a piece of wrought iron. For many years Mr. Whitworth has turned out the change wheels of his lathes, &c., without any trimming. Larger wheels, however, are often trimmed up, as it is not so easy to cast a large toothed wheel quite true. The wooden cogs of mortice wheels are also generally shaped by hand, and this is more especially the case with the cogs of bevel gearing. Cast-iron wheels intended to work with mortice wheels, generally have their teeth trimmed up by hand. This is a costly and tedious operation, but its necessity is apparent. The wooden cogs of a mortice wheel would be speedily worn away by the rough surface of cast-iron teeth.

Steel circular cutters of the exact shape of the tooth are generally used for cutting spur wheels. It will be seen at once that it would be impossible to cut a bevel tooth by means of a circular cutter, without setting the cutter at an angle. The teeth of a bevel wheel of course advance and recede, both as to depth and breadth. Even when a correct circular cutter is used, the wheel is not completely finished by this process; it must be trimmed up by hand-filing. It is scarcely possible to get a correct bevel wheel by means of a circular cutter.

In our number for October 24th, 1862, p. 253, under the heading of "Machine-tool Substitutes for the File" we alluded at some length to the subject of circular cutters, and we there proposed to make a circular cutter for iron upon the same plan as the cutters used in "Biddell's patent oat-mills." It is evident that the circular cutters used for wheel cutting machines might be made in the same way. Circular cutters, formed of one piece of steel, often spring while being hardened, and are also very liable to warp while undergoing this latter operation. When in use, should any teeth be broken off, the whole cutter must be turned up, softened down, and recut. There is also a difficulty in sharpening the edges of the teeth, when the cutter gets worn. Mr. James Nasmyth, of Patricrift, some thirty years ago, made circular cutters out of a number of separate knives, in the following manner:—

He built up the circular cutter out of a number of separate steel cutters, the inside of each cutter being of a wedge shape, and the whole number required were arranged in radii from the centre of the disc. A wrought-iron ring was shrunk on the circular bundle of cutters, so that it could be turned up in the lathe, just as if the cutter were in one solid piece. One side of the cutters is first turned up, and is then fitted into the chuck of the circular shaping or wheel cutting machine. The chuck is furnished with a set-screw, and this screw is caused to press upon one of the separate cutters, which thus acts as a wedge between the other cutters. The wrought-iron ring is then knocked off, and the other part of the circular cutter is turned up in the lathes, so that all the separate knives or cutters are of the same shape.

On slackening the set screw, the separate knives can be easily taken out of the chuck, and filed up to the required shape. On being properly hardened, the knives are replaced in the chuck. They are then screwed up by the set screw, and the whole circular cutter is thus ready for use. Before the modern improvements in moulding, enabling us to cast wheels with greater precision, wheel-cutting and dividing machines seem to have been in greater demand than at present. We have seen, in an old German periodical for 1813, a design for forming a circular cutter for toothed wheels, upon a plan somewhat similar to that of Mr. Nasmyth. The German design was avowedly suggested by Mr. Nasmyth's cutter. A circular cutter for the teeth of wheels must, of course, cut on three sides, taking up the sides and bottoms of the teeth. This kind of circular cutter must also be fixed on a mandrel, and requires to take the shape of a wheel. It is thus impossible to fix such a cutter on the chuck of a lathe; it must be independent of all such support. The way described was the following:—The separate cutters were filed up to a wedge shape, and arranged in radii together; a wrought iron ring being then shrunk on the whole. This steel disc was then placed on a lathe, and the centre bored out to the size of the spindle upon which it was to be fixed. The disc was then fixed on a mandrel, properly turned up to the required shape, and a circular groove was then formed some distance from the centre. This groove was made of a conical or beveled shape, and a ring was fitted into this groove. The ring thus keeps the separate cutters together, when the outside ring was taken off. If this inside ring be once tightly driven into the groove, the outside ring can then be taken off. The steel disc or cutter is then placed on a mandrel, and turned up in a lathe to the required shape. There is a boss on the spindle of the circular cutter, and a nut is screwed up against the other side. The separate cutters are thus kept from being pressed out. These independent cutters can also be separately taken out, sharpened, and hardened, just like Mr. Nasmyth's cutters.

In our volume for 1849 will be found a self-acting method, proposed by a student of St. John's, Cambridge, for cutting the teeth of the drivers of pin wheels or trundles. We do not know whether this plan has ever been carried out.

There were three machines in the International Exhibition for cutting the teeth of wheels; two of these used circular cutters. One was exhibited by Mr. Whitworth, of Manchester, and figured in the western annex. The second machine was sent by Cook and Sons; it was intended more especially for horological wheels, and was on the same general principle as Mr. Whitworth's machine. The machine exhibited in the International Exhibition by Mr. Whitworth, was intended to cut spur, bevel, and screw wheels; in metal or wood. It could cut wheels up to ten feet in diameter. This machine consisted of a long bed, similar to a lathe bed. A circular cutter was used, which was intended to be set at an angle when bevel wheels were required. The circular cutter was on a vertical spindle, working in an adjustable head-stock. The speed of this cutter could be varied to suit wood or metal. The wheel to be operated upon was fixed on the end of a mandrel fitted in a sliding bracket. There was an ordinary dividing apparatus for pitching the teeth. This machine is amongst the best tools of Mr. Whitworth. It no doubt, does its work very efficiently, with respect to spur and screw wheels, but it is subject to the objections we have previously alluded to; when speaking of cutting out bevel wheels by means of a circular cutter. The third wheel-cutting machine was exhibited by John Hunt and Co., of Bow. We have also heard of this firm in connection with anti-friction metal bearings. It was a special tool for dividing and cutting bevel gearing. Although in an out of the way corner, it excited some attention, from its exquisite ingenuity, and as an example of right adaptation of means to an end. The attendant asserted that the machine could pitch and trim more wheels in one day than could be achieved in a week by a good millwright. The apparatus consists, essentially, of a shaping machine with a reciprocating tool. This tool has a stroke of about three inches. The slide is made upon the plan first adopted by Mr. Nasmyth, of Patricrift. The tool box slides on a top and bottom V, and is therefore less subject to any side deviation through wear. In front of the tool holder are two fixed bearings, carrying a cross shaft, through the centre of which is a socket holding a mandrel. On the bottom end of this mandrel is fixed the wheel or pattern to be operated upon. On the top end is adjusted the dividing plate or apparatus. This mandrel has a motion in a vertical plane, and another motion horizontally; out of a composition of these two movements the varying depth and breadth of the bevel teeth are produced. The vertical motion is obtained by means of a worm working in a toothed segment. The feed motion is communicated by a cam on the driving shaft, working into a ratchet wheel. This wheel in its turn works the worm and segment. The depth of tooth for the bevel gearing is thus obtained. The form of the teeth is produced by means of a lever attached to the mandrel on which the work is fixed. In the other end of the lever is fixed the shape of the tooth upon a somewhat increased scale. This templet acts against a steel straight edge on a line with the tool. The vertical motion acting upon this lever works the tooth down, and thus transmits the motion from the templet, to the tooth of the wheel being produced. The templet is kept against the steel straight edge by means of a spring. There is an ingenious spring and detent motion, throwing the vertical movement out of gear when the tool reaches the bottom of the tooth. The dividing plate, to which we alluded before, is set by hand when each tooth is finished, and it is kept in position by a lever and point. This lever is adjustable, in order to regulate the thickness of the teeth. The pitch is given by the holes in the plate. After cutting one side of the teeth, round the whole circumference of the wheel, a left-handed cutter is substituted for the previous tool, which we will suppose to have been right-handed. The templet or shaper is also changed to the other side. The machine is then put in motion to complete the shape of the teeth

We hope next week to be able to illustrate this interesting machine.

In our volume 52, for 1850, p. 97, will be found an account (extracted from the *Franklin Journal*) of "a machine for cutting teeth for beveled gear" then patented in America by George H. Corliss. The machine is not illustrated, but, as far as can be gathered from the description, its principle is slightly similar to the machine of Messrs. Hunt and Co. "A reciprocating cutter that moves in a slide is used, which cutter vibrates on an axis that coincides, or nearly so, with the apex of a cone representing the bevel of the wheel to be cut, and by which vibration the depth of the cut is determined." It is thus seen that the *reciprocating cutter* is adjustable.

The *work* is adjustable in Messrs. Hunt and Co.'s arrangement.

CALIFORNIA AND GOLD.

The enormous and continually increasing supply of the precious metals is one of the most momentous occurrences of modern times. Will the quantities produced ever reach a "point of saturation," to borrow a chemical term? Will the wants of luxury or the requirements of an extending monetary circulation keep up the value of gold and silver? Or are these metals condemned to depreciation by increasing abundance, and by cheapened production? These problems are still agitating the political economists of the day. Some believe that gold is lowering in value by the excessive supply. Other political economists look upon the influx of the precious metal as an immense benefit; believing that gold is the great motive power of commerce and industry,

The Emperor of the French probably looks upon the abundant supply of gold, and its increasing influence on his times, as important questions with which he may have to deal Accordingly, about two years ago, he commis sioned a French engineer to explore the gold regions of California, and to report to him thereon.

The Emperor's orders have been followed by Monsieur Laur, who has published an interesting summary of the gold question, as far as California is concerned, in the second number, for 1863, of the *Revue des Deux Mondes.* We will translate, for the benefit of our readers, some portion of this interesting paper of M. Laur, regretting that we have not space enough for his picturesque geographical account of California. The Sierra-Nevada, in Upper California, is the principal gold region; it is described as a mountain with a literal *cloak of gold.* Upper California is also plentifully supplied with wood and water, the two great requirements of gold mining, and without which the richest gold field would be unproductive. The gold being once discovered, this country, so favoured by nature, only required an industrious population to fully develop its immense resources. Such a population was supplied from the United States, and the North Americans settled down in the country with the enterprizing spirit of their free race. The new land was quickly explored. Its gold flowed over to the Old World with prodigious celerity. The first gold fields were of unheard-of wealth; they were worked with feverish haste, and the production was enormous. The richer fields are now worked out, and the difficulties of extracting the gold have increased. The powers and genius of the workers, however, have not lagged behind. In proportion as the difficulties increased, more powerful means were employed. In most other countries gold digging is a painful toil, at which the gold-washer consumes his strength in working rude washing apparatus. In California, gold mining is now a splendid industry, and it forms a worthy rival to the boldest metallurgical enterprises of the Old World. In order to understand the various mechanical means adopted in California for extracting gold, it will be necessary to give some account of the different forms in which the metal is found.

Science has completely recognised that the gold of California is of more recent formation than the rocks containing the precious metal. Long after the quartz rocks had been formed, one of these geological commotions that have so often shaken our globe took place. Great portions of the Sierra-Nevada hills were raised up at this epoch. The whole mass of our planet was in travail, its solid crust was opened up, and gave passage to some of the fused matter still seething in the interior. These masses surged up in the form of mountains. Currents of sulphur, iron, gold, and other metallic substances, impelled by the force of steam, flowed out of the subterranean furnace. These metallic emanations flooded the country, They oozed into the upper strata of certain rocks, and impregnated them with gold. They entered the thousand fractures caused by the up-heaving of the ground, and were condensed into veins of metal. Such is supposed to be the origin of the *primary deposits of gold.*

These volcanic phenomena probably took place while the continent was covered with seas of water in violent agitation. Further changes consequently took place, and the surface deposits of gold were swept away. The rocks, the gold veins, were dismantled and crushed up, and layers of sand, gravel, and clay, mingled with gold, were spread pell-mell over the country. The gold remained unchanged in the midst of the universal wreck, and separated itself from the gravel formed by the diluvial action. In the lower strata the gold arranged itself into layers, thus forming strata often richer than those of the *primary deposits.* We can distinguish these layers by the name of *ancient auriferous alluvia.*

The surface of the country took its definitive shape after this last geological revolution of the diluvial period. The modern epoch then began, an equilibrium was established between the elements, and everything was given up to repose. New and more gradual influences, however, still continued to affect changes in the arrangement of the gold. The atmosphere disintegrated the rocks, the waters ate away the soil, carrying away the sand, while they left the heavier gold behind. Under these ever-renewing influences, the gold got concentrated in the direction of the main currents of water. This washing action thus formed the *contemporaneous gold alluvia.* The action of the waters was comparatively slight on the hard rocks of quartz, encasing the gold in its *primary formation,* but their action was much more powerful on the *ancient diluvial deposits.* The minerals were thus crushed and washed ready for extracting. These influences extended over many centuries before the gold discovery. The prodigious riches that California suddenly put into circulation were thus found ready formed in the river beds of the country.

It will now be seen that the gold was found in three distinct kinds of deposits. These three sorts varied greatly as regards the difficulty of extracting the gold. The *primary formations* kept the gold stored up in hard and tenacious rocks, requiring to be excavated, crushed, pulverised, and last of all carefully washed, in order to extract the gold dust. The second state in which the gold was found (the "*ancient alluvia*") freely gave up the gold in the midst of gravely soil. Nature had taken upon herself to crush and pulverise the rocks; the washing only remained to be done. The mineral was almost completely elaborated in the "*modern* or *contemporaneous alluvia.*" The grains of the metal shone with their unchangeable lustre in the sands of the rivers, and only wanted picking up. The first Californian gold was found in one of these rivers.

The gains of the gold-diggers were at first perfectly fabulous. The American River produced 5,000,000f. worth of gold within less than two months. This was in 1848. After 1852, however, there was no more virgin soil left in the streams of Nevada. It became necessary to excavate the sands of dried up ravines, to carry away the mineral to be washed, or to conduct the water to the spot itself, by means of expensive canals. The miners found themselves obliged to turn back the water courses of the rivers, to form costly excavations, and to erect expensive machinery for pumping out the water. Nature begun to battle for her treasures, and day by day the miner found his profits diminishing. According to M. Laur, the miner's gains per diem, on an average, 132f. in 1848 and 1849, 95f. in 1850, 64f. in 1851; fell to 25f. in 1853, to 15f. in 1856, and to 13f. in 1858, and were then still so diminishing that the river diggings were entirely abandoned by the white race of gold-miners. The Chinese took their place; and these sober and skilful workers still wash the refuse of their predecessors, in some places perhaps for the tenth time. These Chinese diggers only earn some 3f. or 4f. a day, and even these poor gains are diminishing, so that the river diggings, formerly so abundant, may now be looked upon as almost entirely exhausted.

Calafornia would have shone with but a transient brightness if she had only these river *placers.* There remained, however, the *alluvial deposits of ancient origin,* the veins and the auriferous rocks; the main reservoirs of the precious metal. The questions were, how to work these *dry, hilly, diggings* without water, and how to crush the veins of hard quartz?

The spirit of invention was then called in to aid the spirit of adventure. In the midst of the confused mass of men, private interest organized a regular system of labour. The isolated miner became a rare exception. On all sides associations were formed, and each individual chose the task the most to his taste. Some made the roads, built the bridges, and erected mills; others excavated canals, and distributed to the miners, at so much per measure, the water required for washing the gold. A smaller number excavated the veins of quartz, and imported, at great expense, gold-crushing machinery for breaking up the ore.

The first miner's implement was a large dish of tin plate, or simply of wood. This dish was filled with earth, and shaken up in water, so that the sand was thrown off, while the heavier gold remained at the bottom of the plate. The miner, with this dish, could wash at the most 400 kilogrammes of earth (about 7½ cwt.) per day. In those times, however, he found the river diggings to yield 400 or 500 francs worth of gold per cubic metre. The gold-digger could thus earn 125 to 130 francs per diem. After the dish there came the "*rocker.*" The "rocker" is a small oblong box without a cover, and open at one of the smaller ends. The bottom of the rocker is covered with a piece of coarse cloth. The box is placed on a slope towards the open end, and it can be made to rock to and fro like a child's cradle. A grating is placed on the open top of the box. The earth containing gold dust is shovelled on to the grating. While the apparatus is being rocked to and fro, it is supplied with a stream of water. The heavier gravel remains on the grating, and the earthy matters and the sand pass through, fall down, and roll out, while the gold is kept back by the coarse cloth at the bottom. A miner could wash 1,500 kilogrammes (23½ cwt.) of sand per day with the rocker. This produced four times as much as with the dish, but the soil had become about six times poorer, and the gold-digger only earned 85 francs per day. The "*long-tom*" was then invented, with which the miner, by using a quick current of water, could wash 6,000 kilogrammes (114 cwt.) of sand per day. This was a great advance on the dish; but the progress of invention did not stop here, and the "*sluice*" method of washing was invented. The invention of the "*sluice*" marks a complete revolution in the working of gold.

The *sluice* is a canal formed of three planks, one for the bottom and two for the sides. This canal is narrow, being about 0·30 metres (about one foot) broad, but it is very long, as its length must be not less than 100 metres (328 ft.), and it sometimes measures more than 1,000 metres (3,280 ft.)

The bottom is paved with rough, knotty wood. It is set on an incline, varying with the nature of the soils to be washed, and it is traversed by a plentiful and violent current of water. Five or six diggers ceaselessly shovel in the auriferous soil. The water carries away the sand and stones; but the gold, separating itself from the muddy current, gains the bottom, where it adheres, being seized upon by the mercury there present. The gold is taken out of the sluice once every week.

The invention of the sluice was of itself a fortune for the miners. Instead of only washing 400 kilogrammes (about 7½ cwt.), as with the dish, they could wash 18,000 kilogrammes (342 cwt.); and they could therefore work, with profit soils 45 times poorer. Furnished with this new apparatus, mining adventurers abandoned the rivers, and took up what are called the *dry diggings*, which are situated in the interior of the country.

The first gold deposits worked by means of the *sluice* were the formations belonging to the last epoch of the diluvian period. These formations were the easiest to work, and they consisted of immense heaps of sand and gravel, in which the gold lay bared to the eye, and was easily accessible. These shingle heaps are not much raised above the water courses, so that it was easy to convey the water for extracting the metal. All these gravel heaps contain more or less gold, but the metal is disseminated in a very irregular manner. Some portions contain immense riches, while others are absolutely barren. It often happens that the keeper of a store makes his fortune while the miners can scarcely earn enough to provide themselves with food. The irregularity in the results, renders it very difficult to ascertain the average wealth of this class of gold deposits. It is scarcely possible to state precisely the sums of gold contained in this kind of formation. It will be best to take the average of the results obtained from the present workings. Monsieur Laur estimates this at four or five francs worth of gold per cubic metre. He gives the balance-sheet of an ordinary gold digging enterprise of this description.

Eight miners, with a capital of 4,000 francs, can undertake one of these *sluice* diggings. They would have to build their own house near the spot chosen. This wooden house would cost to build and roughly furnish :—

A sum of about . . .	1,500	francs.
The complete erection of a good *sluice* would cost	1,200	,,
Mercury and tools . .	550	,,
Food for the eight men	750	,,
The miners could then wash 100 tons or 67 cubic metres of gravel per day, which, at 5 francs worth of gold per cubic metre, would give	335	,,

The expenses per diem would be :—

Water bought from the canal companies . . .	25 f.	90 c.
Provisions (3 dols per man and per working week) . .	21	60
Mercury, candles, and tools	10	36
Total expenses per diem	57 f.	86 c.

This being deducted from the 355 francs worth of gold per day, gives a clear profit to the eight men of 277 francs 14 cents. So that each man appears to earn 34 fr. 60 c. per day, his food being paid for.

Such would be the power of production, and the cost price of the gold in the *diluvial deposits*, supposing that the work could be kept up for ten hours a-day. In the above calculations M. Laur has supposed only six men of the eight as being always at work. This is because of the time taken up in the transporting of provisions, and in cooking, &c. He has not taken into account the forced stoppages for keeping the canals, sluices, &c., in repair, and the accidents and waste in working. At the end of the year the amount of the profits is generally reduced from 35 francs to 12 or 13 francs, an average profit, acknowledged by many miners. These gold deposits can, therefore, be looked upon as producing 3½ grammes (about 2 dwt. 6 gr. troy) per man per diem. The full extent and thickness of this particular kind of *placers* have still to be determined. It would be hardly possible to form an estimate with any accuracy. They may be stated to be of such extent that it is scarcely possible to conceive them as ever entirely worked up by the pick and shovel. The excavations already made are merely insignificant breaches in the total mass of alluvium, although so much wealth has been extracted.

It would appear, at first, that the average profit of 12 to 13 francs per day would be amply sufficient to content the gold miners of California. This is, however, not the case. The digger knows that, although he is pretty certain to gain 12 to 13 francs a day, he must give up all hopes of making a *grand coup*, that may enrich him in a short time. He must abandon his dreams of suddenly acquiring great wealth. These deposits at the bottoms of the valleys are also subject to other drawbacks. The excavations made by the first miners got gradually filled with water, and become the *foci* of unwholesome exhalations, engendering dangerous fevers. The miners have therefore abandoned these deposits, and are now working another kind, called *mountain placers*, and in which the genius of the workers has obtained astonishing results.

In our next notice we will give some account of these *mountain placers*, and the interesting mechanical means used for extracting the gold of those peculiar deposits.

Literature.

Algebra Made Easy. Chiefly intended for the Use of Schools. By T. Tate, F.R.A.S., author of "Principles of Geometry and Mensuration," "The Strength of Materials," "The Elements of Mechanism, &c. New Edition. London: Longman and Co.

The rapidly increasing application of the Algebraic system to the working out of mechanical calculations, and the great advantages which palpably arise from its use are, or should be, sufficient inducements for all who are engaged in mechanical pursuits to study it. It is astonishing, indeed, that in a country so far advanced as Great Britain is in arithmetical science, Algebra should have hitherto been comparatively neglected. It has had to contend against a considerable amount of prejudice, and too often the imaginary difficulties which surround it have deterred students from attempting its mastery. The fact is, however, that the only preliminary necessary to the study of Algebra is a thorough acquaintance with the four first rules of arithmetic. If thus armed, we can assure those who are ambitious of acquiring proficiency in this branch of pure mathematics, that the task is not one of great exertion. Patient attention will enable them soon to obtain an elementary knowledge of Algebra, and this once gained, will inevitably lead the pupil to greater achievements in the same department of education.

The little work which Mr. Tate some years since published, and which has very deservedly passed through several editions, "Algebra Made Easy," is eminently calculated for assisting the mathematical tyro. Its teachings are of a transitional character, and they tempt the learner forward by gradual stages, from the plains of common arithmetic to the heights of mathematical science. Once that eminence is reached, not only is the range of mental perception immensely extended, but the thinking faculties become as it were methodised and strengthened. As Mr. Tate truly observes, "an enlightened education ought to cultivate all the susceptibilities of our nature." Algebra, which is peculiarly and justly called the analytic art, exercises, in a way which no other subject can, those powers of analysis and abstraction, which would otherwise lie dormant and enfeebled. The philosopher, embracing within the comprehensive grasp of his intellect the known laws of the universe, was once a feeble-minded child; and in order that such a child may become a philosopher, its powers of analysis and induction should be developed in a manner coresponding to its capabilities. While positive moral training should not be lost sight of, it is important to bear in mind that the patient and reflective spirit which analysis engenders gives a heathful tone, and renders us more capable of enjoying whatever is sublime or beautiful.

On all grounds, intellectual, physical, and moral, is the study of mathematics deserving of commendation; and although Mr. Tate tells us modestly that "Algebra Made Easy" is "chiefly intended for the use of schools," we have no hesitation in saying that it has a further and wider mission. It will assist young mechanics and even many practical men in obtaining an insight into what will by-and-by become an essential of mechanical education. "Algebra Made Easy," commences with the very elementary matter of definitions and notations, and ends with demonstrations of the application of algebra to mensuration.

A Key to Algebra Made Easy. By Thomas Tate. Longman and Co., London.

This is a companion volume to that which has been just noticed, and it is precisely what its name implies. It is unnecessary, therefore, to say more than that we strongly recommend both to the attention of the public.

The Screw Cutters' Guide, containing Tables of Pitches and Threads for every description of Screw Cutting; also, Tables for Gas and Ordinary Taps. By James Martin, 11, Reginald-street, Deptford.

To the mechanic in attendance on a screw cutting lathe, this unpretending little work will be of much practical use. It is dedicated by permission to Messrs. John Penn and Sons, and it is exactly what it professes to be, a guide to screw cutting. The rules are couched in plain workshop language, and the tables are clear and comprehensive. Had the "getting up" of the work, artistically and typographically, been better, and had its price been one shilling instead of two shillings and sixpence, it is our opinion that the "Guide" would have obtained a sale in conformity with its really useful character.

As it is, we recommend it to the notice of the class to whom it is most particularly addressed, and also to managers and foremen of engineering establishments generally. The author has evidently taken much pains to elucidate his subject, and his deductions are clearly the results of working experiences.

INSTITUTION OF CIVIL ENGINEERS.

February 10, 1863.—John R. McClean, Esq., Vice-President, in the Chair.

The first paper read was "Description of the Drainage of the Borough of Dundee," by Mr. John Fulton.

It was stated that, previous to 1851, this town was in a most defective condition, in a sanitary point of view. In that year the borough was brought under the powers of "The General Police Act for Scotland," but owing to a defect in the drainage clauses of the act, the sewerage was not commenced until 1856. It, however, progressed steadily after that date, and was entirely completed in five years at a cost of £52,000.

In designing this drainage, one primary object kept in view was the application of the sewage to some useful purpose, although in the meantime it was allowed to flow directly into the River Tay. Accordingly, the whole drainage, so far as practicable, had been carried to one point—the outlet of a sewer previously constructed by the harbour trustees to intercept the drainage of the town, and prevent it from entering the docks, or tidal basins. This sewer had a fall of 1 in 400, was 7 feet high by 3 feet 9 inches wide, and its discharging was 8 feet below the level of mean tide. The sewage discharged by it, in dry weather, measured 2 feet in depth, and during storms 6 feet. The velocity, in the former case, was 65 feet per minute, and in the latter, 116 feet per minute. The drainage had been carried out by a combination of brick sewers and salt-glazed, fire-clay socket-pipes, of dimensions suitable for the discharge of the sewage and the flood water combined. The whole of the brick egg-shaped sewers were provided with invert blocks of glazed fire-clay. The streets drained by tubular sewers were chiefly those at right angles with the river, which were the steepest, and therefore the most suitable for tubular drains. The proportion of brick sewers to tubular drains was as 1 to 2, the total length of the former being 10 miles, and of the latter 20 miles; and their cost was nearly as 3 to 1, the average of the former being thirty-three shillings, and of the latter thirteen shillings per lineal yard. The leading, or intercepting sewers, had been made from 12 to 18 in. deeper than the lateral and branch drains, with the view of preventing the ends of the latter from silting. It had been found that, with a fall of 1 in 600, the earthy and more soluble matters were carried off by the ordinary rain-fall and sewage, by a proper system of flushing; but a deposit of sand was left behind in all sewers having no greater fall than 1 in 600. It was not apprehended that much annoyance would arise from this cause, as none of the sewers had a less fall than 1 in 700. Passages with manholes had been carried up to the street level from both the brick and the pipe drains, at the junctions of the leading and lateral sewers, and at a distance of 40 yards along each sewer. The junctions for house drains and gullies, consisting of ordinary socket-pipes with bevelled ends to suit the form of the sewer, were built in as the work proceeded. In the case of tubular mains, socket-junctions having an acute angle, were placed at intervals of from 30 to 60 yards apart, or where required for branches, or for gully drains meant for the reception of rain water only. The gases of the sewers were prevented from escaping through the gullies by valves made of stone, and hung with copper links, placed in one side of a small cesspool, the bottom of which was 10 in. below the lower sides of the valves. This form of gully had been found very suitable in Dundee, as the valves freely passed the flood waters, while the cesspools retained all the heavier particles of road detritus. The branch drains had no other trap than the syphon with a cleansing screw, which was placed in immediate contact with the sink, water-closet, or grating used for the reception of soil-water, and in such a position as to be easily accessible.

As the water supply was in the hands of a company, it was thought that the expense of flushing the sewers from this source would have been too great. Consequently the plan adopted was to intercept the sewage, and to turn it into any sewer, or series of sewers, that might be desired. This was accomplished by means of cast-iron gates, placed at the junctions of sewers, and immediately under manholes, and in this way the greater portion of the sewers had been made self-cleansing.

The flushing gates were 15 in. deep only, and they answered the purpose of overflow weirs, preventing the sewers during floods from being subjected to pressure, by allowing the surplus contents to flow into subsidiary outlets, thus equalising the flow of water. In sewers having a less fall than 1 in 600, it was found, as already explained, that there was a tendency to the accumulation of sand; and in pipe drains with even a greater fall, where the ordinary house drainage only existed, sand also accumulated. This occasioned the invention of a cleansing apparatus. When a sewer was to be cleansed, a windlass, containing about 45 yards of iron chain, was placed over each of two adjacent entrance-ways, 40 yards distance from each other. A series of iron tubes was then put together at the bottom of one manhole, and was pushed by hand to the next, where they were again unscrewed as they were drawn through. The chain being attached to the last rod was by this means carried along the sewer, and affixed to the cleansing tool in connection with the other chain and windlass. As the matter to be removed usually consists of hard sand, a tool was first attached to the hooks of the chain, in order to plough, or break it up. When this had been sufficiently done, a scraper formed of strong plate iron, and furnished with small wheels, or moveable axles, on its lateral and lower edges, was next drawn through. It usually required to be moved backward and forward several times before the required cleansing was complete. In the case of tubular sewers, the plan adopted was somewhat different. The scraper did not require any wheels, and the plough was attached to the end of the entering-rod. The cost of cleansing sewers by this mode was, on an average, for tubular drains, one penny, and for brick drains, two pence per lineal yard. No sewer had hitherto required to be cleansed oftener than once in 12 months.

No ventilation whatever has been applied to the sewers in Dundee, and none was contemplated; for although a length of 30 miles of main sewers, and nearly as many miles of branch drains, all closely trapped, had been in use for several years, not a single complaint had been made regarding foul emanations from them. The sewers were kept free of all silt, except sand, by the flow of the ordinary sewage and rain-fall, regulated by the flushing-gates, so that no putrescent substances were retained in the sewers, or drains, to fill them with deleterious gases, and to poison the inhabitants. It was believed it was only where sewers were badly constructed, as regarded their form and water-run, that putrid matters were retained in them, to bring disgrace on the very name of drainage. It was thought that no sewer under 10 ft. in height ought to have an invert of more than 9 in. radius, and that a radius of 6 in. was quite large enough for the invert of any ordinary sewer. When the sewage was confined to such a small compass as this, its scouring power was very great; and if care were taken to have the invert blocks laid to a straight line, there would be but little silting, even with a slight fall.

In conclusion, it was stated, as the result of the drainage of the town, so far as could at present be ascertained, that, as compared with former years, a decided decrease had taken place in the rate of mortality.

The second paper read was a "Description of the Sewerage and Drainage Works, at Newport, Monmouthshire," by Mr. Alfred Williams, Assoc. Inst. C.E., F.G.S.

It appeared that, prior to the construction of the works which formed the subject of this communication, several miles of sewers and drains had been built at different times, but mostly in an imperfect manner, and without regard to any general system. There were nine open outlets into the river, varying in level from 5·4 ft. to 12·9 ft. below high water of ordinary spring tides; and the tide flowed up the sewers, and sometimes flooded the cellars and basements.

In 1856, the author received instructions from the Local Board of Health to prepare a plan for the drainage of the borough, which he so arranged—first, that the outlets were reduced from nine to four, by intercepting sewers necessary for the drainage of the districts through which they passed; power being retained to use the abandoned outlets, without additional works, should circumstances require it. Secondly, that the sewage of two-thirds of the town might be brought to the lowest outlet down the river, near the extremity of the borough; and by a further expenditure, if events should justify it, the greater portion of the remaining third might be carried to the same outlet. This was a new one selected at a suitable point for the distribution of the sewage matter in a liquid form, or for its conversion into solid manure. Thirdly, that the gradients were generally favourable, considering the level of the great portion of the district, the flattest inclination of any new sewer being 1 in 488 near the lowest outlet, and nearly half the entire length of the new sewers, being steeper than 1 in 100. Fourthly, that no cost should be incurred in works, or water for flushing, the plan being so laid out as to take advantage, for cleansing purposes when required, of the land-water and the waste water from the canal, ponds, feeders, &c., in the town, and water being also obtainable, on an emergency, from the water-works at any point.

The plan comprised about seven miles of new brick sewers, varying in height from 14 in. to 4 ft. 6 in.—all above 14 in. being egg-shaped and narrow at the invert—with outlet works; also of a sufficient number of entrances with ventilating shafts, and of street gullies. The contract for the works was let to Mr. John Phillips, and their cost had amounted to £11,862, or about 14 per cent. under the engineer's estimate, which latter was less than the average of nine tenders received for the works.

With reference to the numerous outlets, it was mentioned that the case of Newport was exceptional, the size of the river and the extraordinary rise of tide rendering the amount of sewage matters discharged into it comparatively insignificant. Of the four outlets, two were old, where a large quantity of land-water was discharged. For the remaining outlets, two points were selected suitable for the utilization of the sewage, if that should be found practicable, and not near any houses; where the sewage would have a short and steep run into the stream at low water; and where only short lengths of pipes would be required. When the outlets were closed, the sewers had for a time to act as reservoirs; but no practical inconvenience was found to arise from this, means of ventilation being provided.

The author did not consider it advisable to use stoneware pipes as main sewers, having regard to the circumstances of the town, the existing works, the relative cost of brickwork and pipes, the quantity of debris washed from the roads into the sewers, the difficulty of preventing improper interference after construction, &c. Under the Newport contract, the cost of radiating brick sewers 14 in. diameter and 4½ in. thick, at a depth of 10 ft., with a junction pipe for every house, was 7s. 7d. per lineal yard. This was about the same as a pipe 12 in. diameter, well laid, with junctions. Sewers 2 ft. 6 in. by 1 ft. 10 in., of brickwork 4½ in. thick, similarly constructed, and large enough for a man to pass through, cost 11s. per lineal yard The author generally recommended brick sewers not less than 2½ ft. high for all important lines, excepting where the fall was very great; and he confined the use of pipes to house drainage, for which they were admirably adapted, to short branch sewers on steep inclinations, and to conduits for fresh water.

The bricks were all made by machinery—the clay having been previously passed through a pug mill—some by steam and others by hand power. They had a small longitudinal hollow, which reduced the thickness of the clay, and without materially weakening the brick, caused it to be more dense and more easily burnt. For the 6-inch work, the bricks were 12 in. long by 6 in. deep and 3½ in. thick; and they were found to effect a large saving in many of the sewers, where otherwise two rings of 4½ in. work would have been used. The bricks for the 6-in. and 4½-in. rings were all made to radiate, to suit the invert, side walls, and crown of the several sized sewers; and in order to distinguish readily the different radii, as well as to afford a key for the mortar, groves, varying in shape and number, were made in the sides of the bricks. The inner and outer surfaces were curved, so that when well put together a very accurate sewer was formed.

The sewers near two of the outlets, having to act as reservoirs for about three hours at spring tides, as previously mentioned, their ventilation was effected by a large number of man-holes and ventilators combined, which were placed in open parts of the centre of the roads and streets, at a cost of £1 10s. each complete.

The rate of mortality in Newport in 1850, previous to the adoption of the Public Health Act, was 30·3 per thousand, whilst for the two years ending Michaelmas, 1861, it was rather less than 20 per thousand, or below the average of England and Wales. This very large decrease was no doubt due, under Providence, to efficient drainage and water supply, to the prevention of overcrowding, and to other sanitary measures.

Legal Intelligence.

COURT OF QUEEN'S BENCH, WESTMINSTER, FEB. 9.

(Sittings in Banco, before Mr. Justice CROMPTON, Mr. Justice BLACKBURN, and Mr. Justice MELLOR.)

HYDE *v.* PALMER.—This was an action by the assignee of a patent obtained by one Barsham in 1849, for an apparatus for separating the fibres from cocoanut husks. In 1839 Logan got a patent for improvements in preparing fibrous materials (especially for a new cloth) from the cocoanut husks, his improvements consisting of the application to the fibrous materials of artificial heat, whereby they are subjected to a twist or curl, for the purpose of giving thereto a springy or elastic quality, where they are intended to be used as a stuffing for mattresses, beds, cushions, and other similar purposes; and a particular combination of parts of machinery to perform the operation of "heckling," in the process of preparing such fibrous materials for spinning. In manufacturing the new cloth under this patent, the fibres of the cocoanut, having been first picked or sorted by hand or otherwise, are separated and loosened by means of beaters such as are used in beating hemp, or an apparatus like the apparatus called "a devil" in the flax and cotton manufacture may be used to deprive them of any foreign matters and of such of the fibres as may be too stiff and stubborn for the kind of yarn intended to be produced. This process, the inventor said, must of course be used discretionally so as to separate, cleanse, and sort the fibres with reference to the quality of yarn desired, and the process of carding or "heckling" was effected by machines constructed like the carding or "heckling" machines used in the flax manufacture. In 1841 Logan took out another patent for further improvements in preparing the fibres of the cocoanut and its husk, and under his new process, as he described it, "each portion of the husk or bundle of the cocoanut fibre being in the process caused to turn over and over under pressure, the fibres are thereby by a rubbing action among themselves caused to separate, giving off a large quantity of a very fine vegetable dust, which will be found valuable as a *snuff!*" And by the process the fibres of the husk were to be separated when they were to be further treated and prepared for spinning purposes, by submitting them to the operation of a "devil," or coarse carding-engine. Eight years afterwards (in 1849) Barsham took out the patent upon which the plaintiff now sued, which was for improvements in separating the fibres from cocoanut husks. This patentee alleged that his invention consisted of the employment of crushing rollers, for partially separating and facilitating the separation of the fibres of the husks, and of apparatus having revolving surfaces, with spikes or teeth for separating the fibres. He professed to employ the rollers in crushing the parts of the husk—first in a dry, and then when in a wet or moist state, and he admitted that rollers had been used before for the like purpose, but revolving in opposite directions. And as regarded the second part of the invention, the essence of it seemed to be in holding the piece of husk to be operated upon until the fibres are well combed out, which Mr. Grove, the learned counsel for the plaintiff, ingeniously likened to the act of a lady in combing out her hair, holding it in her hand to prevent the comb getting entangled by any knot in the hair, and so tearing or breaking it, the object aimed at, and alleged to be obtained by the invention, being the combing out the fibre at greater length and with greater thinness and fineness, and, therefore, of greater flexibility, and avoiding the risk of breaking it up into short bits or fragments. Such being the nature of the alleged invention, at the trial of the action before Mr. Justice Blackburn, the novelty being disputed, it was contended that the patent was invalid by reason of a prior user of the invention by one Oakley; and evidence was given that Oakley had, as early as 1846, used a process identically the same, and had for some years sold articles made of fibre obtained by means of that process. On the part of the plaintiff, it was insisted that this user and sale had only been in small quantities, and had not amounted to a public user, which would destroy the novelty of the plaintiff's invention. With this view, one of the witnesses for the defendant was asked, in cross-examination, whether Oakley (who was dead) had not sold a small quantity to one Smith, and, this being answered in the affirmative, Smith was called for the plaintiff in reply, and asked, whether in 1850 (after the plaintiff's "patent") Oakley had not sold him 3 lb. of the fibre, and whether he had not said at the time, "It's a new thing; don't say anything about it;" the object of which was to show that as he treated it as new even after the patent, he could not have deemed that his alleged sale and user before the patent had amounted to a public user or a "publication." This evidence was objected to on the part of the defendant, but pressed and received for the plaintiff, and the learned judge left to the jury the question of novelty on the whole of the evidence. They found for the plaintiff, and a rule had been obtained for the defendant to set aside the verdict upon the ground of improper reception of evidence, and also as against the evidence.—Mr. Grove, Q.C., and Mr. Aston, argued the case for the plaintiff; Mr. Hindmarch, Q.C. (with whom was Mr. Rosher), argued for the defendant.—Mr. Justice Blackburn delivered the judgment of the Court, which was to the effect that there must be a new trial. The inquiry was not as to the object, nature, or motives, of Oakley's act in selling the fibre in 1850 after the patent, but as to his acts of sale and user in 1846 before the patent, whereas the evidence which had been pressed on the part of the plaintiff was as to his declarations in reference to his acts of sale and user after the patent. The evidence was, therefore, inadmissible, and there must be a new trial.

BROMPTON COUNTY COURT.

(Before Sir J. EARDLEY EARDLEY WILMOT.)

WORSSAM *v.* GODWIN.—The plaintiffs in this action are the engineers of the King's-road, Chelsea, and the defendant is a railway grease manufacturer, residing at Lambeth. The action was to recover the sum of £35 for a patent pump manufactured by the plaintiffs for the defendant, from his pattern and under his supervision. Mr. W. B. Davies, solicitor, who appeared for the plaintiffs, in opening the case, said that his clients received the order from the defendant on or about the 27th of February, 1862, to manufacture for him a patent pump. No price was fixed, but the charge was a fair and proper one for the work done and the material used. The defendant was from time to time at the plaintiffs' premises examining the work, superintending experiments and trials, and watching the progress of the same, and never made a complaint of any kind. The work was completed in time for the Exhibition, and, when delivered, was found too long for the space allotted to it in the building. It was then taken back to the plaintiffs' premises to undergo some alteration, which was made in sufficient time for the Exhibition. The pump was afterwards exhibited at the Agricultural Show at Battersea.—The defendant said that the pump was too large. The space allotted to him in the Exhibition was 3 ft. 2 in. by 3 ft., and the pump was 4 ft.—Mr. Charles Parsons, an engineer, who was called for the defence, said that he had examined the construction of the pump under dispute, and he should say that the cost of such a one ought to be £21 10s.—Mr. Henry Thompson, another engineer, said that he should like to have the making of such a pump as the one plaintiffs had constructed for defendant for £18.—By Mr. Davies: The first pump would cost two or three pounds more than the other. If any alterations had to be made he would charge extra for them.—The defendant, in reply to a question put to him by his Honour, said that the pump, in its altered state, did not go the Exhibition, but it was exhibited at the Agricultural Show, Battersea.—After an address from the plaintiffs' attorney, judgment was given for the plaintiffs for £30.

THE INVENTORS' INSTITUTE.

A GENERAL meeting of this Institute was held at the Polytechnic, 309, Regent-street, London, on Monday evening last. The meeting was numerously and respectably attended. In the absence of the President, Sir David Brewster, from ill-health, the chair was taken by Admiral Sir Edward Belcher, C.B., &c., who delivered an able introductory address.

After sketching the origin and progress of the Institute up to its first general meeting, the Chairman said:—The present system involves expenses in securing a patent which press hardly on the man of small means, but too frequently found to be the real practical man of talent. And if the protective patent be withdrawn, then it is but too apparent that wealth alone will carry success, and swamp all poorer competitors; but invention, as the result of the skilled workman, must perish. One of the principal efforts, therefore, of this Institution will be directed to the reduction of patent fees. Next, it is proposed to establish such a library and record of inventions at our established home, when funds admit, as may enable inventors to search leisurely by themselves, if they please, for those inventions which may seem to clash with their own. Further, to receive models, and establish such a museum of inventions as may materially assist, not only inventors from fruitless pursuit, but serve literally as the most ample publication to the world of valuable discoveries which, perhaps, may be unnoticed until their time has expired, and they become public property. In further pursuance of this project, it is proposed to hold, during the customary meetings of other scientific societies, fortnightly meetings, when papers will be read on such subjects as may appear to the Council worthy of discussion. Inventors may here find the opportunity of meeting kindred souls, of interchanging and explaining the merits of their inventions; and, I may remark, that one very important benefit may result from such discussions, namely, that in many instances it may transpire that the supposed invention is not new; that others have preceded and established such claim as will cause them to abstain from incurring further expense and severe disappointment. On the other hand, many inventions for which patents have been obtained, and which have been dormant for the want of adequate means of bringing them properly before the public, may here have new life infused into them, and derive incalculable importance from the opinions evolved during discussion by men whose approbation alone will carry the stamp of undoubted value. Here, also, independently of records, we hope to assemble and benefit by the advice of those men of ripe age, who have buffetted the waves which wash the rocks which beset the patent office—who, from their experience, can discover between invention and borrowing the inventions of others. It is not without some degree of satisfaction that I am able to refer to the present numbers which compose our society. We now can muster in our ranks between 200 and 300 able men; and taking into consideration the short period which has elapsed since the inception of its organization, we have reason to congratulate ourselves that we have attained our present status with greater rapidity than has attended similar undertakings. And further, closely scrutinizing the names and positions in society, we stand well in talent as well as respectability. But let me urge those gentlemen who have hitherto so successfully toiled, as well as new comers, not to relax their exertions until we draw to our support the majority of the talent of the day, and eventually we trust, by our recognised utility and consequence, secure that support and solid assistance from Her Majesty's Government which has been conceded to other institutions which can bear no comparison to this as to public utility and sterling value. We are now, it is true, but an infant institution, but of gigantic promise; and we trust as our library, our models, and means advance, possibly by slow, yet sure degrees, watched, too, by the most rigid regard to economy, that a building fit to contain such treasures as we shall be able to amass may prove one of the most valuable ornaments of this capital. Doubtless it will be urged that we have other institutions already in existence fully capable of carrying out the intentions of this; such might be claimed for the original intentions of the Royal Society, the Society of Arts, and the Institution of Civil Engineers. They, however, have enough to do, and more than they can manage; and it is well known that each of these Institutions demand subscriptions beyond the reach of many talented individuals. As our members increase, we hope, at no very distant period, to attract to our support the first authorities of the day, viewed as genuine inventors; and this Institute may furnish councils of arbitration which may, in very many instances, prevent wearisome and ruinous litigation. We may help to arrest the too ardent inventor from rushing on into endless expense and mortification, by convincing him that his bantling is not his own. We may furnish him with talented assessors, who may help him advantageously, perhaps, to amicable arrangement—consolidation of schemes or of partnership—instead of wasting the sinews of war in complicated discussion in our courts of law. I am not an opponent, nor do I underrate the value of the high talent of those who stand prominent as counsel in our courts of law on patent questions. Far from it. But when the question, stripped of its mischievous technicalities, which sometimes go to rob the true inventor of his rights, has reached careful scrutiny, I should much prefer seeing the matters involved submitted to a jury of half-a-doxen men of known talent in such matters, than to sacrifice, as the law now stands, interests of the utmost value to an ignorant panel, who may return a verdict adverse to every principle of truth and science, because their limited ability or experience prevents their comprehending the matter at issue. I think I have now exhausted the outlines, and our members will deal more lucidly on particulars. Vested interests, probably, will attack our outlines, but we hope, under our inner batteries, sustained by that greatest of weapons—public opinion—we may sustain the shock, and prove that public utility and the best interests of society at large demand the victory.

Several resolutions on the subject of patent law and the cost of patents, together with a resolution pledging those present to support the Inventors' Institute, were unanimously carried, the meeting having been previously addressed by Richard Roberts, Esq., C.E., Thomas Webster, Esq., F.R.S., Hume Williams, Esq., Dr. Normandy, W. C. Fuller, Esq., Dr. Collyer, C. Varley, Esq., and many others. A vote of thanks to the gallant Chairman was also accorded, and the next meeting of the Institute was announced for Monday, the 2nd of March.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

The annual meeting of members of the above-named society took place on Saturday night last, at their Rooms in the City. In the absence of the president, Mr. Mure, of Woolwich Arsenal, was voted into the chair, and the election of officers for the ensuing year was soon after proceeded with.

The Secretary read a letter from Mr. Newton, of the Mint, which, in conveying that gentleman's resignation, thanked his fellow members for the generous support they had accorded him during the four consecutive years he had had the honour of being president. The meeting, however, were unanimously of opinion that Mr. Newton would not be spared from the post he occupied, and he was unanimously re-elected to the presidentship—subject, of course, to his renewed acceptance of it.

Mr. Mure, of Woolwich Arsenal, was re-elected vice-president, and Mr. John Jones, of the Regent's Canal Iron Works, secretary.

The auditors' report, which was next read, exhibited a very satisfactory and healthy appearance. Two new members having been elected, the business of the meeting terminated.

It was announced that the anniversary dinner of the association would take place on the 14th proximo.

SCOTTISH SHIPBUILDERS' ASSOCIATION.

December 1, 1862.

James Rodger, Esq., Vice-President, in the Chair.

(Continued from page 104.)

Remarks on the Build and Equipment of Passenger Steam Vessels. By Mr. George Barber, Shipwright Surveyor to the Board of Trade.

In sections 25 to 33 of the "Merchant Shipping Act Amendment Act, 1862," and Table (C) in the Schedule to that Act, will be found the new regulations respecting lights and fog-signals, which will come into force on the first day of June next.*

If any of you will take a walk up one side of your harbour, and down the other, and look at the position in which the side-lamps of the sailing vessels are placed, I will venture to say that you will find that not more than half a dozen vessels have them placed where they should be. You will find many nearer the stern than the bow, some placed far inboard on the forecastle, and even on the poop, and others behind fixed and permanent obstructions. You will also see that, instead of the screens being of the required length of three feet, the lengths vary from fifteen to thirty inches. One would think that there had been a fixed determination to put the lamps anywhere but in the right place, though, doubtless, it is merely the result of inattention or of a want of due consideration of the importance of the lamps being placed in the most prominent and conspicuous position possible. In the royal navy it is the practice to fix the lamps, in all classes of vessels, as nearly as possible abreast the foremost shroud of the foremast, so that all three lamps may be in one transverse vertical plane; but it is stated, though I am afraid the statement cannot be borne out by facts, that if this arrangement were to be carried out in the merchant service the glasses would be broken by the clew of the fore-sail, or the lamps would inevitably be washed away. The steam-vessels which are fitted out at this port are, as a rule, supplied with lamps of most excellent construction. Small lighthouses some of them are; but I am afraid, from what I have seen, that in many cases the oil which is used is not worthy of the lamp. Cheap oil, or any kind of oil, ought not, for ships' signal-lamps above all others, to be preferred to the best oil; and I am sure it will not be necessary for me to bring forward any argument in support of this statement.

The following extract from the instructions issued by the Board of Trade to their surveyors has reference to signals of distress, and you may, perhaps, consider the remarks about the mortar worthy of consideration:—"The signals of distress are to be carefully examined by the shipwright surveyor, to see that they are kept dry and in good order, and are protected from fire and accident, and that the cannon, which is to be sufficiently large, is in good condition, and ready for use. The signals required are—

12 Blue Lights, or
12 Port-fires and 1 Cannon, with ammunition for
12 Charges.

"Surveyors should call the attention of masters and owners to the advantages of having a 24-pounder mortar in lieu of a gun, to be used as a signal of distress, as it would serve to carry a line to the shore in the event of the vessel being in distress on the coast, and might be the means of saving the crew, when no boat could put off; the life-lines provided for the mortar and rocket apparatus at the various coast guard stations could, in such cases, be made available. Where guns are already provided, there will probably be difficulty in getting the change made; but in the event of old guns being replaced, or in the case of vessels fitting for the first time, it is very desirable that the advantages of the mortar should be pointed out."

You will scarcely believe that in such a simple, though important article of equipment as a life-buoy, economy is often studied before efficiency; but such is the fact. Reeds and rushes sometimes take the place of cork; and although life-buoys made of these present, when new, a very fair exterior, and may perhaps answer their purpose for a few weeks, I have known instances in which, when I have had them thrown oberboard, they have immediately disappeared. Gutta-percha life-buoys have been tried, but the objection to them is their liability to crack. I believe that the well-made cork life-buoys—not those made of cork parings, but those which are composed of segments of solid cork, and covered with strong, well-painted canvas—are the best. And I think it would be a good thing if large passenger steam-ships were supplied with one of that description of life-buoy which you may see suspended from the sterns of her Majesty's ships. It is composed of two hollow copper globes, secured to a framing of wood, and it can be instantly detached from the stern by a trigger. The moment it is set at liberty a fuse, which is attached to it, and which will burn for a considerable time on the water, is ignited, and this serves to indicate the position of the buoy to a drowning person. While I am on this subject, I may state that the life-belts, of which this is a sketch, and which are made on the plan proposed by Captain Ward, R.N., the Inspector of Lifeboats to the Royal National Life-boat Institution, have been found to be a valuable means of saving life;* and I cannot forbear mentioning that the excellent and liberal arrangement, recently adopted by the Cunard Company, of having a good cork life-buoy attached to the end of every sleeping berth in the ship, is well worthy of imitation.

During those days of dense fog which we had last week, I put to myself the question, which I now put to you, Where are the "leads" carried in a steam vessel? You will say, In the wheel-house, or in the mate's room, or, if not there, in the boatswain's store-room., Now you know the importance which is attached to the use of the lead; and why should not the hand-lead, at any rate, be kept always on deck or upon the bridge? It would not then have to be sent for, or sought for, but would be ready to put over the side at a moment's notice.

On looking over the discussion which took place on the paper read to you by Mr. Walker, on the 6th May, 1861, I find it stated that if the Commissioners of Northern Lights were to be applied to, it was most probable that, in conjunction with the Clyde Trustees, they would lay down buoys and establish other appliances for facilitating the swinging of ships for the adjustment of their compasses. I had occasion to be at the Gareloch a few days since, and I find that nothing has yet been done in this matter. I hope it will not be allowed to drop altogether; for I am sure that you must all be aware of the necessity of a careful adjustment, and of the importance of affording every possible facility to the adjuster.

There is one other subject on which, before I conclude, I should like to say a few words. I have often spoken of it privately, and as I have failed to attain my object, I will make no apology for now speaking of it publicly. A great number of steamers are about to be built for your river and coasting service, and I am anxious that, when you are getting out their deck and cabin arrangements, you should make some improvement upon the arrangement of water-closet accommodation which at present exists. The Legislature of this country and of America have, as far as emigrant ships are concerned, laid down fixed rules on this subject; but I want you to take the matter in hand yourselves. I do not complain of the plumbers' department, for there is ample evidence to prove that the Clyde plumbers have given the subject the greatest possible attention; but I complain of the inadequacy and unsuitability of the present arrangements. Come with me on board any of your first-class coasting steamers, and let us see what the cabin arrangements are. A spacious and beautifully decorated saloon; elegant skylights; comfortably arranged sofas; a large and well appointed pantry; state rooms, with sleeping accommodation for sixty or eighty persons; four or six roomy wash basins; but for this large number of passengers, how many water-closets are there? One. Only one. And where is it placed? Anywhere. In any corner, no matter how small or dark, which could not be appropriated to any other purpose. Look into the ladies' cabin. There are eighteen or twenty sleeping berths; and ever in one corner—perhaps placed angle-ways—and opening directly upon the heads of two tiers of sleeping berths, there is a door—not larger than one of the doors of your bookcase,—and this excludes from view a miserable, uncomfortable, little bit of a sentry-box, not more than thirty inches square, and barely high enough to sit upright in. We will not go and look at the accomodation provided for the fore-cabin and steerage, for if we do we shall turn away in disgust. Your river steamers are as bad, if not worse, in this respect; and I firmly believe that many a passenger has suffered and many a one will suffer, an untold amount of agony, rather than enter one of these wretched, dark, ill-contrived, badly-ventilated places, which are a disgrace to the other arrangements of the vessel. No doubt a great deal may be said about the carelessness of passengers themselves; but in these new steamers which are about to be built, and of which such great expectations as to speed and beauty are entertained, see whether you cannot make some improvement. Give more room, more liht, more air. In the ladies' cabin take it out of the corner, and give it a square, roomy place by itself. And in the river steamers see whether you cannot arrange a fit place for any one to go into. If you will do this, you will have the thanks of that large multitude of passengers which crowd your steamers during the whole of the summer season. It is also very desirable that an improvement should be made upon the present arrangement of companions and ladder ways in your river steamers. Every one who has travelled in your river steamers must have experienced the inconvenience of the present arrangement, and many, I doubt not, have with myself, thought how utterly impossible it would be, in the event of an accident occurring, for the passengers in the cabin to get upon deck in a reasonable time. No one would now think of putting a narrow, inconvenient staircase, with the old fashioned, dangerous, wedge-shaped steps into a house, and why should you continue to put them into your steamers? Why not put the companion in the middle line, and give a wide, easy stair? You would get quite as much passenger space on deck; there would be less danger to children and females when descending; and in the event of an accident happening to the vessel, the passengers would be able to get upon deck without that confusion and loss of time which would be sure to arise from the obstruction caused by the present arrangement.

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* The sections referred to were read to the meeting, and copies of the Act can be had from any publisher for eighteenpence.

* During the storm of the 9th February, 1861, the Whitby life-boat capsized, and twelve out of thirteen of her crew perished, the man saved being the only one who had on a life-belt of this description.

I have directed your attention to a great many subjects, and I now invite you to a discussion upon them. I have had something to say about iron decks and ships built of a combination of wood and iron; about the plaining of butts and the necessity of pipes which pass through the ship's side being exposed to view; about preservatives for ships' bottoms and the importance of keeping the inside of iron vessels well coated; about leaky forcastles and square butts to deck planks: about rudders and rudder-pendants; chain cables and hawse-pipes, and a chain testing machine; about pumps and pump roses, boats, boats' davits, arrangements for giving buoyancy, appliances for lowering and disengaging, and the desirability of boats being exercised; about signal-lamps and signals of distress, life-buoys, leads, and compasses. You may, perhaps, have thought that some of these were matters scarcely worth speaking about; but, trivial as they may appear, they have an important bearing upon safety; and "safety" you know is the only text which I have to study. I hope you will not think that I have spoken too plainly; and if what I have said will induce you to take the matters to which I have referred into your consideration, and to give to safety some share of that attention which I have reason to fear is too often given to saving, I shall not regret having occupied this evening so much more of your time than I intended.

The CHAIRMAN.—I am sure we have all listened with great interest to the remarks and suggestions made by Mr. Barber, and I hope that any member who may wish to offer any observation upon, or to discuss any of the numerous topics which have been referred to, will now do so.

Mr. DUNCAN.—I have heard with surprise the statement made by Mr. Barber respecting side-lamps. I had thought that, as a rule, vessels built and fitted on the Clyde were most particularly attended to in that respect.

Mr. BARBER.—I did not intend my remarks about the positon of signal-lamps to apply to any particular vessel or vessels, but to the sailing vessels generally frequenting the port. I shall be glad to hear from any member who may be disposed to go and see for himself, that my statement is incorrect. I hope that, by the next meeting, there will not be a sailing vessel in the port to which my remark about the position of lamps will apply.

Mr. BOOLDS, of Greenock.—I would like to ask Mr. Barber whether he is of opinion that all vessels should have iron decks, or to what class or description of vessel he considers iron decks most useful as a means of strength?

Mr. BARBER.—I believe that iron decks are very valuable in vessels whose length bears a great relative proportion to their breadth and depth, So much longitudinal strength is afforded by them. In small vessels the necessity for iron decks is not so great.

Mr. DUNCAN.—Who can understand now-a-days what is meant by a long ship? At one time five times the beam was considered an extraordinary length, but now we think nothing of making vessels of a length of nine times the breadth.

Mr. BARBER.—I will not dispute that there is a difficulty in comprehending what is meant by a "long ship." I believe, however, that if, after a voyage, a vessel shows unmistakeable signs of weakness, it is a proof, not, perhaps, that the length is too great, but that the strength is insufficient for the length. The dimensions of the first iron vessels with iron upper decks which came under my observation were 300 ft. × 34 ft. × 24 ft.; the next were 310 × 34 × 24; the next were 335 × 34 × 24, and I believe that some vessels are now being built of the dimensions of 390 × 34 × 24.

Mr. BROWN, of Renfrew.—I did not exactly understand Mr. Barber's observation about shaft-tunnels. It is not necessary that tunnels should now be made water-tight.

Mr. BARBER.—You will not find any mention made of screw-tunnels in the Act of Parliament. The Act required the bulkheads to be entire and water-tight; but on its being represented that great inconvenience was caused by the engineers having to go out of the engine-room into the after-hold or after-cabin to get at the bearings, the Board of Trade consented to an entrance being made through the bulkhead, provided there was a water-tight tunnel and a water-tight sliding over the entrance. Under this arrangement no water could get from the engine compartment into the after-hold, nor from the after-hold or stern-tube into the engine compartment. Builders and owners are at liberty now to make their own arrangements of bulkheads and tunnel, and I trust that they will not depart from those arrangements, which, as regards safety, have hitherto been found to be so valuable.

MR. DARLING.—Are we then to understand that an owner can send a passenger vessel to sea without bulkheads?

MR. BARBER.—He may do so, but it is not probable that he will take upon himself the reponsibility of doing so if it be the general opinion that bulkheads conduce to safety. Owners have hitherto thought it sufficient to have a clause put in their specifications to the effect that the "Bulkheads are to be to the satisfaction of the Board of Trade surveyor." They have felt assured that the vessel would not get a certificate if the bulkheads were not as they should be. In future, however, they will have to trust entirely to their own inspectors, or to the builders, and not, as the have hitherto done—to the Board of Trade surveyor. The surveyor may not have the legal power to insist upon bulkheads, but he will have to satisfy himself that the vessel is sufficiently strong for the service for which she is intended, without regard, however, to the probability of her going upon the rocks. Masters must take care to keep their vessels off the rocks.

The CHAIRMAN.—But is it not a fact that in all cases in which an iron ship has gone ashore she has parted at the bulkheads first?

Mr. BARBER.—No; it is not a fact. It is the popular notion, but it is not a fact. The instances in which vessels have parted at the bulkheads are very few in comparison to those in which vessels have been saved. The former cases are noised abroad; the latter are seldom if ever published, and are known only, perhaps, to the owners, to the crews, and to the surveyors. The tendency to tear at the bulkheads might be, and has been, obviated by the simple method of doubling the ship's side in the wake of them.

The CHAIRMAN.—That would only make the vessel more rigid at those particular places.

Mr. BARBER.—Well, I will not go so far as to say that bulkheads give strength to a ship. I will not go into that question. I contend, however, that a vessel with properly fitted water-tight bulkheads has, within herself, a means of safety that a vessel without bulkheads has not; and I will also maintain that bulkheads can be fitted in such a manner as not to weaken the ship. I could refer to many, very many, instances in which vessels of all classes, and when engaged on all services, have been preserved from sinking, after having been in collision with icebergs, or with other vessels, by their bulkheads.

The CHAIRMAN.—I believe that bulkheads are most valuable in cases of collision, and I do not believe that the repeal of the 300th section of the Merchant Shipping Act will in any way affect the practice of fitting bulkheads which has been hitherto carried out by the Clyde shipbuilders.

Mr. BARBER.—I hope not. I hope that bulkheads will continue to be water-tight bulkheads, not thin "brown paper" divisions, put in merely to keep the engines and boilers apart from the cargo and cabins.

Mr. SKINNER.—It cannot be expected that a man is going to build a ship to run upon the rocks. He wants his ship to carry his cargo, and to do her legitimate work. Running upon rocks is not her legitimate work, and if the surveyors will see that vessels are made strong enough, and are sufficiently equipped for their legitimate work, it is all that the public can reasonably expect from them.

Mr. ARMOUR.—I beg, sir, to move that Mr. Barber be requested to allow the remarks which he has made to be printed, so as to form part of the proceedings of this association.

Mr. HAMILTON seconded the motion, and it was carried unanimously.

Mr. BARBER, in reply, said that the remarks which he had made had been very hurriedly put together, and with the intention that they should not form part of the regular proceedings of the association, but as the meeting appeared to be of opinion that they were calculated to do good, he would not object to them being printed.

A selection of specimens of iron and steel (numbering 490), upon which the experiment published in Mr. Kirkaldy's book were conducted, were then examined by the meeting, and a short discussion took place, in which the truthfulness of the inferences deduced by Mr. Kirkaldy was made manifest. Many of the members bore testimony to the patience and impartiality with which the experiments had been conducted, and to the care and precision with which the results had been arranged and recorded.

LIST OF THE SPECIMENS CONTAINED IN FIVE CASES, namely:—

IN CASE I.

9	Iron bars, showing elongation and laternal contraction.		
1	Iron plate,	do.	do.
1	Steel plate,	do.	do.

IN CASE II.

42	Steel bars, showing fractures and contraction of area.		
105	Iron bars,	do.	do.

IN CASE III.

36	Steel plates,	do.	do.
60	Iron plates,	do.	do.
24	Angle iron, &c.,	do.	do.

IN CASE IV.

36	Iron bars, showing fractures and effects of difference in the shape.		
40	Iron bars, showing fractures and effects of difference in the treatment.		
12	Steel bars,	do.	do.
10	Iron plates,	do.	do.
15	Iron bars, showing fractures and effects of strains suddenly and gradually applied.		

IN CASE V.

46	Iron bars, showing fractures of screwed bolts.		
12	Iron bars, showing fractures of welded joints.		
2	Steel bars,	do.	do.
26	Iron bars, showing textures as developed by acid.		
8	Iron plates,	do.	do.
1	Iron plate, showing surface "cold-rolled."		
4	Iron bars,	do.	do.

Mr. BOOLDS proposed, and the meeting unanimously accorded, to Mr. Kirkaldy a vote of thanks for the trouble he had taken in arranging his collection of specimens for their examination.

SOCIETY OF ARTS.

FEB. 11, 1863.—W. R. GROVE, Esq., Q.C., F.R.S., in the chair.

The paper read was "On Submarine Telegraphy," by Mr. Thomas Webster, M.A., F.R.S.

The author observed that this subject naturally resolves itself into the questions of the route, the cable, and the means of submersion. Public attention had been directed to three routes across the Atlantic—the central, the northern, and the southern, each presenting peculiar advantages and difficulties; the first being the one to which attention was directed in 1856, and in which the cable was actually laid. Since that great experiment much precise information had been attained as to the working, and the speed attainable in circuits of great length. It appears to have been ascertained that the rate of working a number of signals transmissable through two lines, identical in every respect except as to length, is inversely as the square of the ratio of the lengths. This, which depends on a physical law of nature, is wholly independent of artificial and external conditions, as the insulation, which, however perfect, cannot effect the comparative results, and the shorter must always, in the author's opinion, have a commercial advantage over the longer cable, which must necessarily influence the selection of routes. These and other considerations have called attention to two other routes for the Atlantic telegraph cable; one, the northern, from the west coast of Scotland, by the Faroe Islands, Iceland, and Greenland. to the east coast of Labrador, and the southern from the south coast of England, by the Canary and Cape Verd Islands to St. Paul, a small island in the South Atlantic Ocean, and thence by the island of San Fernando to Brazil, and so along the coast of British Guiana and the West India Islands to America. Both these routes present a convenient mode of dividing the distance into a series of short and manageable circuits. Mr. Webster stated the reason for his opinion that the laying of the cable on these routes, in comparatively short lengths, would present no serious difficulties, though the number of shore ends was doubtless a disadvantage. He thought that the submerged cable in the Northern Atlantic, would, in the opinion of the most experienced sailors, run little risk of damage. An accurate knowledge of the bottom of the ocean was of the greatest importance to such a question, but even this knowledge might be bought too dear. Soundings in deep water, say from 1,500 to 3,000 fathoms, over a breadth of four or five miles, would present serious difficulties, and would occasion a delay unfavourable to the success of the enterprise. The question of the cable was, however, secondary to the selection of the route, as the weight, dimensions, and construction of the cable would in all probability be different for the Central or Northern Atlantic; still these questions were matters of great importance; the author proceeding to touch upon the principal points on which difference of opinion existed, such as the alleged objections to the spiral construction of the external wire covering, the substance to be used for insulation, the influences of magnetism and the *aurora borealis* on cables already laid, and other matters. He then passed to the question of the best mode of laying the cable, touching incidentally upon the different sorts of strains to which cables of high and low specific gravities were respectively exposed during this operation. In conclusion, he expressed an opinion that a regular inquiry by competent persons into all these subjects would lead to most valuable result.

PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS.

ON THE MANUFACTURE OF HEMP AND WIRE ROPE.

BY MR. CHARLES P. B. SHELLEY.

(Continued from page 94.)

As the spinner proceeds down the walk he tosses the yarn with his left hand on to one of the hooks in the rafters, in order to support it; and in coming back he jerks it off again. The distance of one-third, two-thirds, and 160 fathoms, are chalked on the side of the shed, and as the spinners of each set come to the distance, they shake their yarns, and thus signal to the man at the machine for the yarns to be unhooked and reeled up. Each spinner is paid in London 9d. for spinning six threads or yarns, each 160 fathoms long; this is called "one quarter's work," and each spinner spins four threads an hour.

The yarns are distinguished and designated by their size or number of thread, every size being numbered; the ordinary numbers, beginning with the coarsest yarn and going to the finest, are 18, 20, 25, 30, and 40. Number 20 is the most usual size, and is employed for "London staple cordage;" number 25 is used for Government yarns, number 30 for bolt rope yarns or the finest description of cordage, and number 40 for whale lines. In spinning number 20 size, the "shorts," are always worked in with the "long hemp;" but for finer sizes, 25, 30, and 40, "long hemp" alone is used, in order that the yarn may be even and smooth. The size of the yarn is determined by the number required in each strand to make a rope of 3 in. girth with three strands; thus the size of number 20 yarn is such that 20 yarns in each strand will make a rope of 3 in. girth with three strands. Number 20 is said to be the usual "grist;" number 25, 30, and 40, are said to be finer "grists."

If the cordage is to be tarred, it is done at this stage of the manufacture, before the yarns are formed into strands; but the process of tarring the yarns will be described subsequently.

When the reel behind the spinning machine has been filled with the four lengths of yarns spun, it is taken to the winding machine, which separates the four yarns on to four separate bobbins, and also reverses the lay of the yarn end for end so that the fibres may lie in the proper direction for passing through the next process. The full reel containing the four yarns from the spinning machine is mounted on a temporary frame behind the winding machine, and the ends of the four yarns are led to the bobbins over a sliding bar, which has a vertical reciprocating motion given to it by the cams and levers, for the purpose of filling the bobbins regularly and equally from end to end. Other forms of winding machines are used, but the principle of construction is the same in all. When the four bobbins are filled, they are replaced by empty ones, until the whole of the reel from the spinning machine is wound off upon bobbins. The four full bobbins are then taken away and placed vertically in a large wooden frame called the bobbin frame, which holds from 150 to 200 bobbins. Each bobbin contains about 14 lbs. of yarn.

The next process is that of twisting a number of yarns together into a strand, which is termed "forming," and is done in the "forming" machine, and in the shed covering the rope walk. Having ascertained the number or size of the thread that is of sufficient thickness to form the required strand, the number of yarns corresponding to that size of thread are selected; and the ends of the yarns of this size are drawn from the bobbins and brought in a converging direction to a square iron plate, called the "register" plate, perforated with a number of round holes. Each yarn is made to pass through a separate hole in the register plate, and the yarns all converge thence into one common point through the forming board, in which is a taper steel tube with a trumpet-mouthed taper hole through it. The hole in the tube varies in diameter for each size of strand, and is selected by a gauge: the diameter of the tube for one of the strands for a rope of three inches girth is eight-sixteenths of an inch at the small end, and nine-sixteenths of an inch at the large end, and for the strands of a rope of two inches girth, it is five-sixteenths of an inch at the small end, and seven-sixteenths of an inch at the large. The convergent yarns are entered into the tube at the large trumpet-mouthed end, and are forced through, fitting tightly into the tube; they are thus squeezed together previously to being attached to the forming machine.

In the next process the strands are "laid" into a rope by two "laying" machines, one at the upper end of the walk and the other at the lower end. In this process, instead of being twisted together as the yarns are in the previous "forming" process, the strands are placed or "laid" in their spiral position in the rope without being twisted. The laying machine at the upper end of the walk is fixed, and the three strands to form the rope are attached to the hooks, which are made to revolve in a similar manner to those in the previous forming machine, by the fly rope passing round the wheel. The lower end laying machine is left free to travel part way up the walk as the length of the strands becomes shortened by their being laid into a spiral in the rope. The wheel drives two "forelocks," to one or other of which the strands are made fast, according as the twist of the rope is to be right-handed or left-handed. The three strands for the rope are stretched tight along the length of the walk from the hooks of the laying machine at the upper end to the forelock of the lower laying machine, and are supported off the ground and kept separated by means of posts, called "samson posts," placed at every five fathoms' length, with pegs to carry the strands. A taper piece of wood with three grooves, called the "laying top," is then inserted between the strands close to the lower machine, with its smaller end towards the forelock, one of the strands lying in each of the grooves. A transverse hole is made through the laying top, through which is passed the "top stick" or handle that the top is held by. The laying tops are made of various sizes according to the size of rope required: for a rope of 3 inches girth, the top is 12 inches long, 10 inches diameter at the larger end, and 8 in. at the smaller. When the rope is more than 3½ in. in girth, a "top cart" is used for supporting the top.

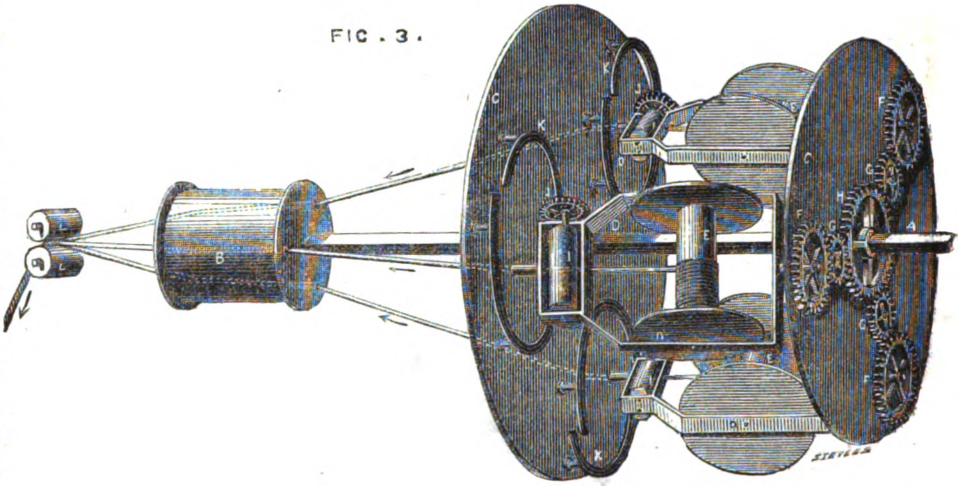
The laying machines being put in motion, the revolution of the forelock gives the twist or "hard" of the rope, while the laying top is firmly held by the handle from turning. The hooks at the other ends of the strands are made to revolve in the opposite direction to the forelock which is twisting the rope, so that the twist put into each of the individual strands, at the point where they are united into the rope immediately behind the laying top, is taken out again by the hooks at the upper end. The laying top is gradually pressed forwards by the closing of the strands upon one another behind it; its motion requires to be very regular, and it is prevented from moving forwards too fast by a "tail" or piece of rope attached to the top handle, which is coiled round the rope already twisted, and thus acts as a drag to the top. The two laying machines must be driven at exactly the proper speed relatively to each others so that the twist put into the separate strands at the laying top may be exactly neutralized by the revolution of the hooks: otherwise if the hooks revolve too slow, they will partially untwist the individual strands, since the twist of the yarns in each strand is in the contrary direction to that of the strands in the rope; or if too fast, the strands will become twisted tighter. In order that the man holding the laying top may find out how the machines are working, whether too fast or too slow relatively to each other, he makes a mark on one of the strands close to one of the supporting posts: if the strands are being twisted too fast by the hooks of the upper laying machine, the mark on the strand advances towards the upper end of the walk, from the yarns themselves becoming twisted tighter together in each strand, whereby the length of the strand is shortened; but if too slow, the mark recedes towards the lower end, from the partial untwisting and consequent lengthening of the individual strands. In laying the strands care is required with regard to the angle that the strands take. Should the tension on the strands become unequal, the required additional twist is given to those which have got slack by throwing out of gear those hooks of the upper laying machine to which the tighter strands are attached, and allowing the others to continue revolving until all the strands have again become equally strained. As the formation of the robe proceeds, the lower laying machine is gradually drawn up the walk by the shortening of the strands as they are laid together into the rope; and weights called "press weights" are placed on the frame of the machine to retard its motion and hold the rope tight enough during the laying Formed strands of 180 fathoms length will make 120 fathoms o hawser-laid rope; the length of the strands will be determined by the length of rope required.

After the rope is taken off the laying machines, it is coiled on to a drum driven by steam power, being guided from end to end of the drum by the workman, whose hands are protected by a piece of old cordage twisted on the rope that is being coiled; this gives a polish and finish to the surface of the rope.

The previous description has referred only to ropes manufactured by hand. In the application of machinery to this manufacture, which is next to be considered, Mr. Cartwright appears to have invented the first rope-making machine, which is the basis of others since constructed, his "Cordelier" having been brought out in 1792. Fig. 3 shows a sketch of the cordelier, which revolves on the horizontal shaft A, the laying-top B serving as the bearing at one end of the shaft, having holes through it for the strands to pass through. In the discs C C fixed on the shaft A are centred the three horizontal spool frames D, carrying the spools E which contain the three strands to be laid together. As the cordelier revolves, the axes of the spools are preserved constantly parallel to themselves by the spool frames D being made to rotate on their bearings once for every revolution of the machine, by means of the pinions F on the spool frame bearings, and the counter wheels G gearing into the central dead wheel H, which is of the same diameter as the pinions F, and is held stationary while the shaft A revolves within it. The bearings at the other end of the spool frames D are hollow, for the strands to pass through to the laying-top B. The strand is drawn off the spool by the pair of delivering rollers I, which receive motion by a worm wheel J on the axis of one of them gearing into the worm K, within which the spool frame revolves. The drawing rollers L L draw the finished rope forwards as fast as it is made, and hold it from turning.

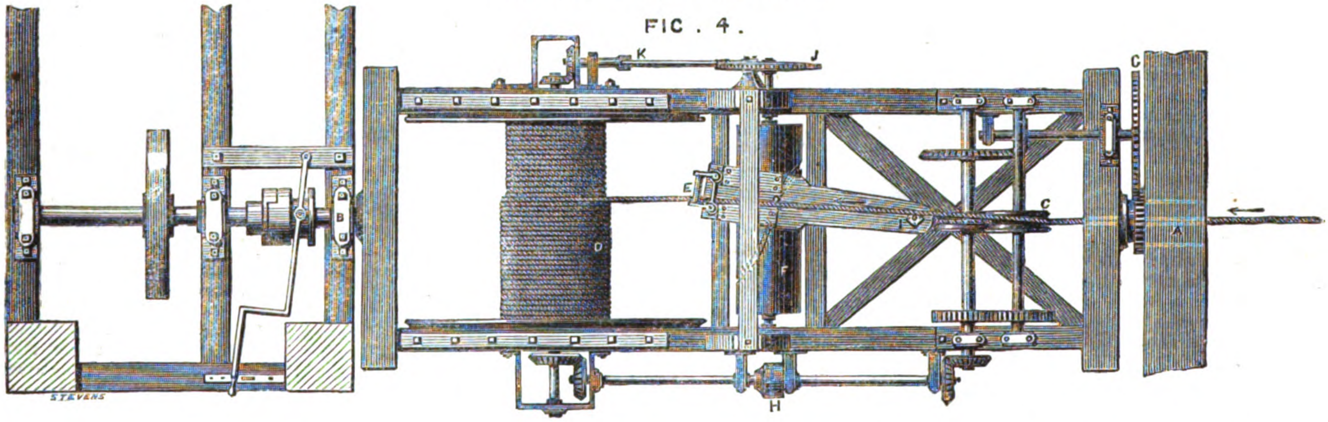
CARTWRIGHT'S CORDELIER.

FIG. 3.



THE REGISTERING MACHINE.

FIG. 4.



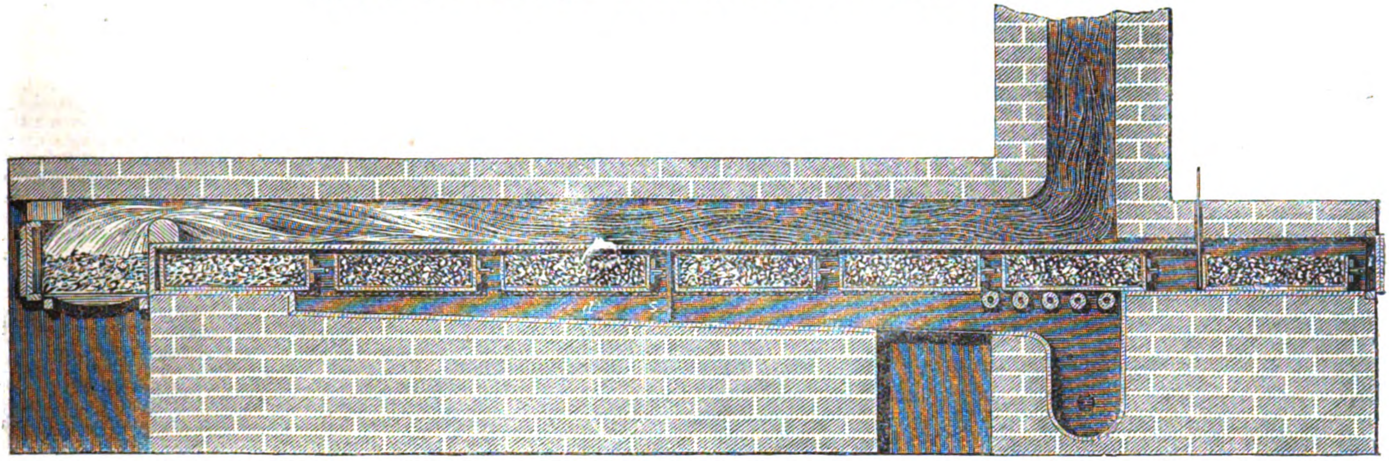
This machinery was a few years afterwards improved upon by Capt. Huddart, who constructed machines that were used for a number of years at the Deptford dockyard for spinning the yarns and for the manufacture of ropes and cables; and the author is mainly indebted for the following particulars of the construction of this machinery to a description and drawings given in the professional papers of the Royal Engineers by Mr. John Miers.

If the ropes are to be tarred, the tar is applied to the yarns on leaving the spinning machine. For this purpose they are first wound off from the drum behind the spinning machine upon a winder called a "whimwam," made of a light open frame of iron and wood revolving on a horizontal shaft. The loose ends of the four yarns on the drum are attached to a hook at the right end of the winder, which is then turned by a winch handle to wind the yarns on, the yarns being being guided on from end to end by a traversing plate with four holes in it which receives the required traverse motion from the shaft of the winder. On reaching the left end of the winder the yarns are doubled round the hook at that end, and the winch is then turned in the opposite direction, winding the yarns on till they reach the right end, where they are similarly doubled round the hook at that end, and the winding is then again reversed. When a sufficient quantity of yarn has been put on the winder, the hook at one end is taken out and the yarn is uncoiled from the winder, thus forming a long skein called a "haul," which is then coiled upon a small circular revolving platform called a "turntable," about 4 ft. diameter, mounted on wheels. The haul of yarns is then taken to the tarring shed, and uncoiled from the turntable into a cauldron of tar heated by fire or steam; one end of the haul is lifted from the tar, and means of a capstan is drawn through a sliding nipper or squeezer for the purpose of squeezing out the superfluous tar from the yarns. After the haul has lain for some time, the longer the better, the four yarns are separated and wound on to four bobbins by the winding machine previously described; and are then passed to the bobbin frame ready for being twisted into strands. Capt. Huddart did not make the yarns into a haul previous to tarring, but passed them from bobbins direct from the spinning machine through the tar and thence through nippers to the register plate of his registering machine about to be described. The length of a haul is 55 fathoms; it contains about 144 threads, and takes about 20 minutes to pass through the squeezer from the tar cauldron, that is about 16 ft. in a minute. The tar used should be the best Archangel tar, of a good bright colour, and heated to a temperature of 212 deg. Fahr. The usual proportion of tar remaining in the yarns is from one-quarter to one-fifth of the weight of the untarred yarns. The yarns when tarred ought to be of a bright brown colour.

The "Registering" Machine, shown in plan in Fig. 4, is for the purpose of twisting the yarns into a strand and winding the strand upon a drum as fast as it is formed. The whole machine revolves with rapidity on the horizontal bearings A B, being connected with the driving power by a sliding friction crutch at B. The strand enters through the hollow bearing A, which grips it tight and thus twists the yarns into the strand by its revolution. The strand is drawn in by the pair of drawing pulleys C, taking half a turn round each, and is delivered upon the winding drum D by the guiding frame E, which is made to move from end to end of the drum by means of a stud on the frame working in a spiral groove cut in the barrel F. The drawing pulleys C, winding drum D, and grooved barrel F, are all driven from the spur wheel G gearing into a stationary pinion fixed to the plummer block in which the bearing A revolves. As each successive coil of strand wound on the drum D increases its diameter, whereby an increased tension would be thrown on the strand, a friction clutch is inserted at H in the intermediate shaft which communicates the driving motion from the drawing pulleys C to the winding drum D, in order to prevent the drum from overwinding the pulleys, the friction being adjusted to the exact limit of tension desired in the strand. The guiding frame E which delivers the strand from end to end of the winding drum vibrates on a centre at I, and its rate of travel is varied for different sizes of strand by changing the worm wheel J on the spindle of the grooved barrel F; the universal joint K allows of the driving worm being set at different inclinations for gearing into a larger or smaller worm wheel J.

The strand made by the registering machine is wound off the drum D on to a loose reel, so that when transferred to the drum of the spool

WILLIAMS'S APPARATUS FOR THE DISTILLATION OF COAL AND PEAT.



Longitudinal Section.

frame in the laying machine it may lie the same way end for end as on the drum D, in which state it is ready for being laid into a rope. The length of the strand is measured by passing it over a pulley of definite diameter, to which is attached a counter with a dial indicating the number of fathoms of strand that have passed over the pulley.

(To be continued.)

WILLIAMS'S APPARATUS FOR THE DISTILLATION OF COAL AND PEAT.

Mr. W. M. Williams, of Handsworth, has recently patented an arrangement of apparatus for the distillation of coal and peat, and such other substances used in the manufacture of volatile hydrocarbons. The accompanying engraving shows a longitudinal section of the furnace. The distillatory vessel or chamber, having a top or cover, is made of iron, and constitutes the bottom of the reverberating arch. The bottom of the distillatory vessel or chamber is inclined as represented, the lowest end being that most distant from the fire. A portion of the bottom of the distillatory vessel or chamber is made of thin sheet zinc, and is unsupported by brickwork.

The object of this arrangement is hereinafter explained. The distillatory vessel or chamber expands downwards, near the back of the furnace, and forms at that part a condensing chamber, which may be cooled by water. The distillatory vessel is prolonged beyond the condensing chamber, as shown. This prolonged part is terminated by a door, and may be temporarily cut off from the distillatory vessel or chamber by a valve or damper. At the furnace end of the distillatory vessel or chamber is a lateral chamber, which opens at one end into the distillatory vessel or chamber, and at the other into the air. The said lateral chamber may be closed by a door, and may be cut off from the distillatory vessel or chamber by a valve or damper. This chamber forms the discharging chamber. The trays containing the coal or other matter to be treated, may be run in on rails. Or, instead of rails, a series of rollers may be employed. The position of a few of these rollers is indicated in the engraving. The coal or other substance to be operated upon is placed in shallow trays, which may be from 6 to 12 in. deep, and square or oblong in shape.

In using this invention the fire is lighted, and maintained in the furnace to keep the iron plate at a bright red heat at that part nearest the fire. The trays being filled with the coal, peat, or other material to be operated upon, are introduced into the charging chamber one at the time.

The door *i* of the chamber having been closed, the damper or valve is raised, and by means of a rod passed through a hole in the door the tray is pushed into the distillatory vessel or chamber *d*, and on to the rails or rollers. The tray thus introduced is left for a short time at that part of the distillatory vessel or chamber most distant from the furnace, when a second charged tray is introduced in a manner similar to that by which the first was introduced, the second tray pushing the first before it. Other charged trays are introduced until the distillatory vessel or chamber is filled with them, the one first introduced having arrived at the end of the distillatory vessel or chamber nearest the furnace. The contents of the trays having been sufficiently heated after they have been respectively brought to the furnace end of the distillatory vessel or chamber, and allowed to remain there, being the interval elapsing between the introduction of one tray and the introduction of that succeeding it; the trays are withdrawn from the furnace end at the same rate as others freshly charged are introduced at the charging chamber. The withdrawal of the trays is effected at the discharging chamber, placed latterly as before described. In withdrawing a tray the door is closed, and another valve or damper raised; the tray is pulled out by a rod in a similar manner to that described for the charging. The interval of time allowed between the introduction of the trays is such that the distillation of the material in the first tray shall be nearly completed by the time when it reaches the end of the distillatory vessel or chamber nearest the fire. As the distillation proceeds the vapours pass downwards to the space between the rails or rollers and the inclined bed of the distillatory vessel or chamber, and the less volatile vapours are there condensed, and flow downwards to the condensing chamber, where the more volatile vapours are condensed. A large pipe conveys the liquid hydro-carbons from this chamber, together with such more volatile vapours and permanent gases as may still remain uncondensed. The liquid products of the distillation are collected in vessels or tanks, and the uncondensible portions allowed to escape; or the latter may be collected and burned for illuminating or heating purposes.

When it is desired to separate the products of the different stages of the distillation, the patentee introduces sliding partitions at different parts of the distillatory vessel, so as to preserve the products condensed at different parts separate. The said partitions are withdrawn during the moving of the trays.

The zinc plate forming the lower end of the inclined bed of the distillatory vessel or chamber, is introduced as a safety valve in case of explosion. It is made as thin as possible, and communicates with an open space below. The rest of the furnace being strongly built, the said zinc plate on account of the small relative tenacity of zinc gives way in case of explosion, and the gases escape downwards through the opening without injuring the workmen or destroying the furnace.

THE ROYAL SOCIETY.

At a recent meeting of the Royal Society, with Major-General Sabine in the chair, a communication was read "On the Rigidity of the Earth," by Professor William Thomson, F.R.S.

The author proves that unless the solid substance of the earth be on the whole of extremely rigid material, more rigid for instance than steel, it must yield under the tide-generating influence of sun and moon to such an extent as to very sensibly diminish the actual phenomena of the tides, and of precession and nutation. Results of a mathematical theory of the deformation of elastic spheroids, to be communicated to the Royal Society on an early occasion, are used to illustrate this subject. For instance, it is shown that a homogeneous incompressible elastic spheroid of the same mass and volume as the earth would, if of the same rigidity as glass, yield about 7-9ths, or if of the same rigidity as steel, about 2-5ths of the extent that a perfectly fluid globe of the same density would yield to the lunar and solar tide-generating influence. The actual phenomena of tides (that is, the relative motions of a comparatively light liquid flowing over the outer surface of the solid substance of the earth), and the amounts of precession and nutation, would in one case be only 2-9ths, and in the other 3-5ths of the amounts which a perfectly rigid spheroid of the same dimensions, the same figure, the same homogeneous density, would exhibit in the same circumstances. The close agreement with the results of observation presented by the theory of precession and nutation, always hitherto worked out on the supposition that the solid parts of the earth are perfectly rigid, renders it scarcely possible to admit that there can be any such discrepance between them as 3 to 5, and therefore almost necessary to conclude that the earth is on the whole much more rigid than steel. But to make an accurate comparison between theory and observation, as to precession, it is necessary to know the absolute amount of the moment of inertia about some diameter; and from this we are prevented by the ignorance in which we must always be as to the actual law of density in the interior. Hence the author anticipates that the actual deformation of the solid earth by the lunar and solar influence may be more decisively tested by observing the lunar fortnightly and the the solar half-yearly tides.* These tides, it may be supposed, will follow very closely the "equilibrium theory" of Daniel Bernouilli for all oceanic stations, and the author suggests Iceland and Teneriffe as two stations well adapted for the differential observations that would be required.

The earth's upper crust is possibly on the whole as rigid as glass, more probably less than more. But even the imperfect data for judging referred to above, render it certain that the *earth as a whole must be far more rigid than glass*, and probably even more rigid than steel. Hence the interior must be on the whole more rigid, probably many times more rigid, than the upper crust. This is just what, if the whole interior of the earth is solid, might be expected, when the enormous pressure in the interior is considered; but it is utterly inconsistent with the hypothesis held by so many geologists that the earth is a mass of melted matter enclosed in a solid shell of only from 30 to 100 miles thickness. Hence the investigations now brought forward confirm the conclusions arrived at by Mr. Hopkins, that the solid crust of the earth cannot be less than 800 miles thick. The author, indeed, believes it to be extremely improbable that any crust thinner than 2,000 or 2,500 miles could maintain its figure with sufficient rigidity against tide-generating forces of the sun and moon, to allow the phenomena of the ocean tides and of precession and nutation to be as they are.

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* High tide, as far as the influence of either body is concerned, is produced at the poles, and low (average) water at the equator, when its declination, whether north or south, is greatest, and low water at the poles and high water at the equator, when the disturbing body crosses the plane of the equator.

"On the Difference in the Properties of Hot-rolled and Cold-rolled Malleable Iron, as regards the power of receiving and retaining Induced Magnetism of Subpermanent Character." By George Biddell Airy, Esq., F.R.S., Astronomer Royal.

The author states that he had been desirous of examining whether differences in the degree of change of subpermanent magnetism, such as are exhibited by different iron ships, might not depend on the temperature at which the iron is rolled in the last process of its manufacture. By the good offices of Mr. Fairbairn, he had received gratuitously from Richard Smith, Esq., Superintendent of Lord Dudley's Iron Works at the Round Oak Works, near Dudley, twenty-four plates of iron, each 16 in. long, 4 in. broad, and ¼ in. thick; twelve of which, after having been manufactured with the others in the usual way, had been passed through rollers when quite cold. Each set of twelve was divided into two parcels of six each, one parcel being cut with the length of the bars in the length of extension of the fibres of the iron, the other being cut with the length of the bars transverse to the length of extension.

For experimenting on these, a large wooden frame was prepared, capable of receiving the 24 bars at once, either on a plane transverse to the direction of dip at Greenwich, or on a plane including the direction of dip. In some experiments, these planes are covered with flag-stones, and the bars were laid upon the flag-stones; in others, the bars were laid immediately upon the wood. While there lying, they were struck with iron or wooden hammers of different sizes. The bars of the different classes were systematically intermingled, in such a way that no tendency of the arm to give blows of a different force or kind in special parts of the series could produce a class-error in the result. For examination of the amount of polar magnetism in each bar, it was placed at a definite distance (5 in.) below the prismatic compass, which was used to observe the apparent azimuth of a fixed mark; the bar was then reversed in length, and the observation was repeated in that state.

The number of experiments was 21. They were varied by difference in the succession of positions of bars, difference of time allowed for rest, difference in the violence of the blows, &c.

The principal results appear to be the following:—

1. The greatest amount of magnetism which a bar can receive, appears to be such as will produce (on the average of bars) a compass-deviation of about 11°, the bar being 5 in. below the compass. It was indifferent whether the bars rested on stone or on wood, or whether they were struck with iron or with wood, the bars lying on the dip plane while struck.

2. When the bars, thus charged, lay on the plane transverse to the dip, they lost about one-fifth of their magnetism in one or two days, and lost very little afterwards

3. When the charge of magnetism is smaller than the maximum, the diminution in a day or two is nearly in the same proportion as for the maximum.

4. The effect of violence on the bars, when lying on the plane transverse to the dip, is not in all cases to destroy the magnetism completely; sometimes it increases the magnetism.

5. The cold-rolled iron receives (under similar violence) or parts with (under similar violence) a greater amount of magnetism than the hot-rolled iron, in the proportion of 6 to 5.

6. There is some reason to think that the hot-rolled iron has a greater tendency to retain its primitive magnetism than the cold-rolled iron has.

7. There is some reason to think that, when lying tranquil, the hot-rolled iron loses a larger portion of its magnetism than the cold-rolled iron loses in the same time.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to M. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

A. D. (Newcastle).—We do not think that there is any work published on the subject. We will inquire further, and, if successful, will let you know the result in our next number.

T. S. (Manchester).—It is very difficult to get one of these appointments without powerful interest.

L. F. (Bradford).—By sending 1s. 2d. in stamps to Mr. Bennett Woodcroft, Patent-office, Southampton-buildings, London, you can get the specification.

A. P.—The greatest *authenticated* speed on a railway is about 80 miles an hour.

H. M.—We believe that 1,000 cubic feet of gas have about the same heating power as 1 cwt. of coal.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our Correspondents.*]

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SUBMARINE TELEGRAPHY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In a letter which appeared in the MECHANICS' MAGAZINE of Feb. 6th, an anonymous correspondent endeavours to show that my proposed scheme of a deep-sea survey, for telegraphic purposes, is visionary and impracticable. Had the writer in question taken the trouble to assure himself of what has really been said or written by me on the subject, instead of relying on "abstracts," for the accuracy of which he must be aware I am in nowise responsible, I should have respected his opinions, however much they may be at variance with my own. But when "An Old Sailor," "for the honour of his cloth," as he pompously intimates, is content to furnish the public with a *rechauffe* of the unsupported assertions of others, to "affirm" this or that, under cover of an *incognito*, and to resort to misinterpretations, which are inexcusable, inasmuch as they were avoidable, no alternative is left me but to expose his weakness.

Taking the sequence of topics as they occur in "An Old Sailor's" letter, I beg to observe that my method of survey, across a two-mile longitudinal belt of the Atlantic, was based on the belief that, wherever "lines of soundings" have been heretofore laid down on our charts, the position of each cast might be depended on. In short, that these lines of soundings are, what they profess to be, *trustworthy, and not falsified records.* I candidly confess such to have been my belief when I projected my scheme; and, what is more, that it shall continue to be my implicit belief until far more weighty evidence is adduced to the contrary than has as yet been made public.

What I did state I repeat, namely, that, under sufficiently skilful management, a steam ship can maintain her position over the point at which a sounding is being taken without drifting so far as to vitiate the observation. But this view is not mine only, although I am in a position to confirm it from personal experience. It is the deliberately expressed opinion of Sir Leopold M'Clintock and Captain Dayman, as I am prepared to show. Consequently the onus of proving it to be impracticable to sound without drifting five, ten, or even fifteen miles during the period occupied in a single operation—as recently asserted by Sir Edward Belcher—rests with him. When he makes good his assertion, it will be time enough to condemn my project, but not till then.

As regards the catechetical mode of testing my knowledge of the methods of taking observations at sea, I have only to say that unknown querists must rest content to have as little value placed on their questions as on their "affirmations" as to whether my plan would "take nearer five or six years to accomplish than as many months."

Your space, Sir, is too valuable, and my time too fully occupied, to admit of my splitting straws, however much time "An Old Sailor" may have to devote to such an accomplishment. But the question he raises hinges on no specious mode of putting the case regarding Lieutenant Sainthill's sounding. In my observations at the Royal Geographical Society, I distinctly pointed out that *some years previously* to the date at which Captain Dayman's 3,000 fathom sounding was taken, Lieutenant Sainthill's cast of 100 fathoms had been reported. So that "An Old Sailor's" acute sensibilities stand him in no good stead, however laudable they may be.

Had Admiral Elliott and Sir Edward Belcher "assured the meeting that all my foraminifera and diatoms were nothing but young oysters," I might certainly have been somewhat surprised; but assuredly not half so much surprised as I was to hear the assertion of the last-named officer with reference to drifting, of which mention has already been made.

To any knowledge of "seamanship" I have not pretended. But I do pretend to an ordinary knowledge of the laws that govern matter; and when I suggest the *buoying up of a light line attached to the telegraphic cable* (instead of supporting the cable itself, as imputed to me), I am constrained to suspect that "An Old Sailor's" pretensions to a like knowledge are questionable—to say the least of it.

The last point of "An Old Sailor's" attack, however, attests the true animus under what his letter was written. He says he is "jealous of the honour of his cloth." Far be it from me to attempt to deny what his language so unequivocally proves without my aid. But he refers me "to the *preface* of Charles Darwin's Naturalist's Journal of the 'Beagle's' voyage" if I wish to see what I have left undone in not acknowledging, in the first part of my work on "The North Atlantic Sea-bed," services rendered me by Sir Leopold McClintock and the other officers of H.M.S. "Bulldog."

Now, I do not know how long your anonymous correspondent may have been "tied to his chair in the country with an attack of gout"—which would appear to have been the primary piece of news he had to communicate to the readers of the MECHANICS' MAGAZINE, seeing that it takes precedence of everything else; but this I do know, that it never has been, and, if I can help it, never shall be, laid to my charge, that I fail to acknowledge kindnesses. And, had "An Old Sailor" allowed me to rest on my oars until the publication of part 2 of my book—the only portion of it in which a preface could be inserted—he would have spared me a little trouble, and himself no little ridicule.

Heartily wishing him a happy deliverance from his only enemies, the spleen and gout, I beg to subscribe myself his and your

Most obedient servant,
G. C. WALLICH.

Kensington, Feb. 7th. 1863.

SIR,—The subject of Transatlantic telegraphic communication being still under consideration it can do no harm for a non-scientific individual to state an idea which has frequently occurred to him, namely, that the cable should be laid in the usual manner, in the comparatively shallow water on either side of the Atlantic, and when (as on the banks of Newfoundland and elsewhere) the soundings are favourable; but that in the intervals of deep waters the cable should be submerged as follows:—That at stated intervals of so many miles, these intervals to be tested by experiment, the cable should be sunk beyond any possible contact with the keels of the largest known vessels, by means of sufficient weights, over which buoys strongly constructed should be placed, having electric communication with the cable. I am not sufficiently scientific to know whether the strain would be too great on so long a line of cable thus suspended, but I do not think it would. Assisted by vessels of all nations, rendezvoused at stated points, the cable might be thus submerged in a couple of summer days. I do not think that stormy weather would strain it beyond what might be guarded against.

Vessels might occasionally damage the buoys, but this would only be a rare accident. In the event of any interruption of communication, the defective portion of the cable might be discovered by experiment to ascertain between which of the buoys the defect lay. In the event of a rupture of the cable itself, the ruptured ends could be traced by following the line of buoys. I have no doubt that buoys at ten or fifteen miles apart would answer the purpose of submersion.

Some of your scientific contributors may be able to prove that such a scheme is impracticable; however, any plan that is not open to the objection to which ordinary submersion is liable, namely, that once damaged the entire cable is lost for ever, is worthy of consideration.

I am, &c.,
Edinburgh, Feb. 10, 1863. I. J.

A similar plan to the above was suggested in our columns by Dr. Wallich, on the 5th of December last.

PATENT LAW REFORM.

Sir,—As the Commission appointed to consider the Patent Laws is sitting, this subject is becoming important. It is to be hoped that practical suggestions will be freely given in the Mechanics' Magazine on this subject. The first thing to be done is to get out a sketch of such proposed rules as may be laid before the public and the Commission. This I hope to be able to do in a few days.

A chief difficulty in settling questions of infringement is the present character of the jury. This is no easy matter to deal with. The best suggestion I can give is, that a *scientific jury* should be appointed in patent causes. Even this is only an approximation towards a satisfactory decision in such cases, but it seems at present the best. What are the views of your readers on this subject? Now, I think, is the time to express them: at least, I humbly so suggest.

Another difficulty in patent causes is the character of the tribunal. At present this description of causes are tried in one of the superior courts of law which have co-ordinate jurisdiction. Justice Cockburn has lately, as is well known, somewhat set his face against the trial of such causes. This is not to be wondered at, considering the general complexity which besets the evidence. In addition to this, patent causes take, generally speaking, more time than other causes, and they frequently hinder the trial of commercial actions. There is, I believe, a growing desire for a Patent Law Court, to be presided over by a judge who shall devote his time and attention *exclusively* to this branch of jurisprudence. Now, what is the opinion of your readers as to this?

Other matters relating to "specifications," "letters patent," and "disclaimer," I shall have presently to lay before your readers. The machinery of a patent, though decidedly improved by the Act of 1852, admits, I think, of further improvements. There is, I find, a growing disapproval of the restrictions on trade which are the results of patents, and this fact should not, I suggest, be overlooked by inventors. No doubt "monopolies" somewhat "clash" with *moral* rules, and furnish instances of opposition between the laws of this country. This being so, we cannot wonder that Bentham had, as I believe is the fact, serious doubts as to the continuance of monopolies in England. These hints I throw out *suggestively* and *significantly* for the consideration of your readers. It follows, I think, that "too much" must not be expected from the Legislature, and the duties of the present session of Parliament will not, I fear, admit of the consideration of "nice questions" in such a subject as this.

I am, &c.,
J. Culverhouse.
3, Compton-street, Ballspond,
6th Jan., 1863.

PATENT LAW.

Sir,—The recent extraordinary trial of Clare against the Admiralty has given the *Times* an opportunity to renew its hostility to inventors generally. Its remarks, in a leading article on Saturday last, were pertinent enough as far as concerned Mr. Clare's claims, but the attack on all inventors was as unjust as it was absurd, though I do not think there is any danger of the opinions of the *Times* having any weight with the parties entrusted with the consideration of the patent laws.

I will attempt to define an invention. The world is on the road from ignorance to wisdom; every improvement in any mode of accomplishing any object, every increase of economy in time, labour, or materials, is a step forward on this road from ignorance to wisdom, and the person who performs it is as much entitled to be rewarded as he who writes an article for the *Times*, or builds a house, or parts with a field. Invention being the fruit of his labour, it is his property, and if his fellow men avail themselves of the facilities afforded for robbing him of this kind of property, without remunerating him, they are quite as dishonest as the housebreaker who steals your goods.

Suppose an enterprising man to set up a printing establishment, and at the earliest possible moment every morning to get some copies of the *Times*, distribute them among his compositors, and in an hour or two print off some thousands of copies of the *Times* (without the advertisements) and sell them at one penny each. What would the proprietors of the leading journal say to this? Would they call it just? Yet this would be no more unjust than what they propose to do with patentees, viz.: the sweeping away of all protection.

But the *Times* proposes to reward deserving inventors by public grants! Shade of Cort, arise! What a Will-o'-the-wisp for a genius to pursue. How poetic, to invent and starve, and probably when the next generation arises, to have one's name mentioned as a fit subject for a monument in a niche in a public building.

What we want, Mr. Editor, is good and cheap protection for really good inventions, with a chance of getting some reward before the heavy sums become payable, and a ready means of quashing trumpery claims to invention.

There is, however, one want which I have long felt should be supplied. A man invents something useful in his trade, and is willing to give it to the world; but the moment he publishes it, some other person, who has a six months' provisional protection running, with a sufficiently comprehensive title, immediately adopts the unprotected invention, inserts it in his complete specification, and stops the real inventor from using his own invention without a license from the purloiner.

To meet this, and cases of a similar character, I would have a class of patents to be called "Public Patents," the entire office fees to be one guinea only, and the patent immediately to belong to the world. It is true the same thing may be done at present by abandoning a provisional protection, but this is at the heavy expense—including agent's fees—of £10, and the title "abandoned" is ugly. I think if this class of "Public Patents" is established it will be productive of much good, and prevent many speculative and mischievous patents from being granted, besides taking away some of the false arguments used by the opponents of protection.

I am, &c.,
1, Clifford's Inn, Feb. 9, 1863. T. Moy.

WHITWORTH PROJECTILES.

Sir,—Dazzled by the brilliancy of the success obtained by Mr. Whitworth with his steel shot, in overcoming the resistance of iron plates, the authorities seem to have been unable to perceive the conclusion rightly to be derived from it. They appear to attach some mystic importance to the method of rifling, and the form adopted for the shot—an importance which is neither born out by the result of experiments, or by the investigations of theory.

The direction which Mr. Whitworth's success indicates that we should take, in order to arrive at increased efficiency of artillery fire in penetrating iron, lies simply in the employment of shot composed of very hard and tenacious metal, and moving at high velocities.

The nature of the grooving in the bore of the gun, by which the shot's rotation is enforced, is, no doubt, a matter concerning which the plate impinged on is profoundly indifferent; while the explanation by which it has been usually sought to prove the superiority of the flat over the round fronted shot, is far from being incontrovertible. A more probable theory might be advanced to show cause for the superiority of the flat front, when the metal composing the shot is comparatively soft, as has been the case in all experiments where any superiority was manifested by the "flat heads."

It may, I think, be safely asserted that, with shot composed of the hard and tenacions metal adopted by Mr. Whitworth, the result of their impact will not be materially affected, either by rifling or by peculiarity of form; and I venture to assert that a "68"-pounder shot, composed of the Whitworth steel, and projected with the usual velocity from a 68-pounder gun, will, at a range of 200 yards, penetrate the "Warrior" target.

I am, &c.,
Feb. 10th, 1863. Iron.

"FUNICULAR" ACTION.

Sir,—As you have favoured me on a former occasion with a space in your columns on the score of humanity, I again venture in the same strain, for it is quite lamentable to read of the many deplorable accidents with such sacrifice of life, limb, and property; and I feel assured that if you, and some of your scientific readers, will give your powerful aid to the subject, a check will be given for the future to such as may be considered "mechanical accidents."

Soon after the disaster at Notting-hill, I went and saw the fallen arches, and it brought to my mind the occurrence at the South Lambeth Waterworks, an account of which is in Vol. 62, page 558, Mechanics' Magazine.

Shortly after that mishap I read somewhere a letter from a continental correspondent, which stated that the English architects did not thoroughly understand such work. When, lo! in the following June, a wholesale affair occurred at the new waterworks at Brussels, see Vol. 63, page 85, Mechanics' Magazine. So that the English did not stand quite alone at that time.

My meaning for using the term mechanical accidents, is for such as might possibly be foreseen by those who have a good knowledge of mechanical action. I became a little more acquainted with it as follows:—During the time of the building the station at King's-cross, I was much interested by seeing the compassed wooden girders put up to form the building, and as it approached something like completion, I was quite at a loss, after walking around the place several times, to know why the wall in Maiden-lane, and the inner piers adjacent, should not yield to the pressure?

Just at that time I was an eye witness to some experiments going on with some arches, constructed with brick and cement, being loaded with iron till they fell; and as I could not glean anything from the person who superintended the work and the loading, I set to, and cubed some of the debris, crushed them by leverage, and made a small apparatus for evening amusement, with which I treated arches as triangles, and could tell to a little what was the lateral thrust with a given load on the arch. I then made a drawing like an arch of the King's-cross station, with the following remark:—A lever of the fourth order, a simple instrument for throwing down a wall.

A little time elapsed, when of a sudden there was great bustle at the said station; the wall and inner piers were yielding on the Maiden-lane side: abutments were strengthened, wooden frame-work put in lieu of brick arches; and so it remains to this day.

A few years rolled on, when I procured a work brought out in 1837, by Mr. Adams, on English pleasure carriages, in which it states:—"An authority of high repute, Mr. John Farey, author of the well-known work on the steam-engine, has added to the ancient catalogue of the 'mechanical powers' two others, viz.: 'The Funicular Action,' 'The Hydrostatical Action.'

After duly considering the said "Funicular Action," of its probable connection with past accidents, and possibly with accidents to come, I wrote the following:—"Funicular Action, mentioned at page 63, should be well understood by a coroner; he would be then able to solve the query,—Why a chain that will sustain a weight of ten tons appears to fail with the weight of one ton, scaffolds fall, bridges, &c., &c." If I had been a little more liberal I might have added architects, engineers, surveyors, and others, superintending mechanical works of any kind.

The word funicular is seldom seen or thought of. It was to be seen in the western annex of the Exhibition of the past year,—"An Austrian Locomotive."

That the said action has a great deal to do with accidents I feel quite certain; and, with a better knowledge, some of the following cases possibly could have been avoided:—

Scaffold at St. Martin's-hall; scaffold under the bridge on the Thames; stone at King's-college; another at the Victoria-docks; the bridges at York and Harrowgate; the gun at the steam crane at Woolwich, in frosty weather; fall of a fly-wheel on a person at Ballspond; girder at the Crystal-palace; the almost accident to a female Blondin, when the side rope or ropes broke; the breaking of a copper wire which let a female Blondin down in the pit of a theatre—it was said the copper was bad; English Blondin at Shields, when a boy was killed by the falling of poles, or shear legs; Blondin with his man on his shoulders, when they fell in the laps of the audience in the gallery—the railing gave way; the female Blondin and man of colour at Northfleet, by the breaking of one shear leg; wall and piers at King's-cross station; arches at Brixton, at Brussels, at Cotton's-wharf, and many others that have actually fallen, apparently without rhyme or reason; of the pier that sunk at Notting-hill, and likewise at Clapham, there is no foundation to say the cause was "funicular action," or a triangle of forces; but the arches that fell in consequence were! and so was the Fleet-ditch; for I consider it to have as much to do with the ditch as with the telegraph wire which broke and killed one person on Blackfriars-bridge, and injured another.

There is an amount of pressure or strain that seems to escape consideration.

Not long since there was a fatal case on a portion of the North-Western line, when Gardener, the brakesman, was killed; and, I doubt very much whether that would have happened, if the said action had been but little understood by those who had to right the carriages.

I once saw a large boiler let down to its bed with strong scaffold poles for shear legs, and pulleys, &c.; a guy rope was attached to one pole, some three or four feet above where the poles crossed each other, and was secured somewhere at a right angle; when the weight was getting heavily on the legs, the one pole bent so much, and the guy rope stretched so enormously, that a fresh start was required. Had the guy rope been fixed at an angle of 45 deg. instead of a right angle, a much less weight would have had the same effect; and, if the materials used had not been of the best description, down she must have gone. The following experiments and questions seem to be in one way or the other connected with the aforesaid cases:—

If a pound weight be suspended from the centre of a bar by a string, or wooden slip, it is clearly seen that there is a strain of one pound on the bar. "The weight of the material is not considered." The result is the same if the slip and the weight are placed above the bar. Now, if the said bar is half-inch square, and rests on bearings two feet apart, the strain on the under side of the bar "by the weight" is several pounds, and the compression on the upper side is to the same extent. With two slips of wood, each 12 in. long, which are to be used between two piers, one pier is provided with a weighing machine, to ascertain the lateral pressure, the other pier is moveable, to make the slips form any angle required; one end of each slip rests on a pier; the other ends meet at a point. When the slips are loaded, there is not only an aditional vertical weight on the piers, but a lateral thrust, which "force in a building" would act on a tie rod if placed there; if without a tie rod, and the material is not thoroughly set, and the piers of sufficient weight and base, they will yield; and then down goes the mass.

If two uprights, with a pulley on the top of each, are placed three feet apart, and a line passed over both, with a provision at each end of the line to receive weights: any weight hung on the horizontal part of the line, "at any point," will give an amount of strain to the line, which will be indicated by the amount required on the vertical parts of the line, to bring the line between the uprights to any required angle.

Two piers ten feet apart, between which is built with cement an arch of one brick thick, 4½ in. by 9 in., the spring 4 in—what weight fairly laid on will crush it? What will be the pressure against the piers, at the crushing point?

With a wire one-eighth of an inch in diameter, capable of sustaining a weight of 1,000lbs. vertically, and two uprights 12 ft. high, and 300 yards apart, with a guy wire to each, fastened at top, and 3 ft. from the base. It is required that the wire shall be fastened to the top of uprights, with a 14 lbs. weight, hung on the centre; and the wire at centre must only deflect 9 in. What will be the strain on the wire; and what on the guys; will the 14 lbs. break the wire? What will be the vertical pressure on the uprights? When fixing the wire, should it be payed out from a revolving reel, and partially straightened as it leaves? Or taken from a coil, and be in a high state of torsion, when stretched? Less mischief would occur from the former than the latter.

If a piece of work had to be placed in position, the weight of which is 16 cwt., and there happens to be some obstacle in the way, so that the slings must be kept extremely low; if the slings form an angle of 5 deg. from the lifting hook to the bearings on the load, each half would have to sustain a weight equal to about 5 tons 12 cwt., and yet be calculated to carry a load of only 1 ton 5 cwt. If the angle was—

		Tons.	Cwt.	
10 deg.	the load would	= 2	8	each.
20 deg.	,,	= 1	4	,,
30 deg.	,,	= 0	16	,,
45 deg.	,,	= 0	12	,,
90 deg.	,,	= 0	8	,,

It is really surprising that disaster is not more frequent, for the said action is synonymous in respect of arches, truss girders, slings, &c.

And now I must leave the subject to a more cultivated mind, and apologise for the intrusion.

I am, &c.,

Feb. 1, 1863. G. B.

ON GRAVITY ESCAPEMENTS FOR CLOCKS.

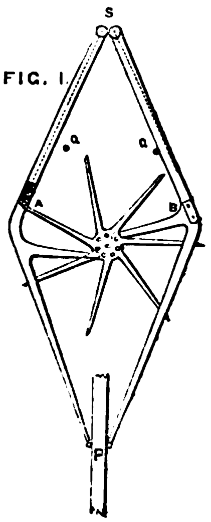
Sir,—About ten years ago you published an account, from the Cambridge Philosophical Transactions, of the gravity escapement which I invented for the purpose of enabling a clock for Fredericton Cathedral to go properly in a temperature cold enough to freeze mercury. That, and some other forms of the same invention, have now been used long enough and extensively enough to afford more complete means of estimating their fitness for different kinds of clocks than existed when the fourth edition of the "Rudimentary Treatise on Clocks, Watches, and Bells" was published, or the short appendix to it two years ago.

I need hardly explain to any one who is likely to read this, that the distinction between gravity or remontoire escapements and others is, that in the common ones the pendulum receives its impulse directly from the clock, and the impulse therefore varies with the state of the clock, the action of wind and snow on the hands, and other disturbing causes; while in gravity escapements the clock only lifts small weights called pallets through some definite space corresponding to a small angle of the pendulum's vibration; after they are so lifted, the pendulum takes them up alternately, and carries them with it as far as it goes, and then they fall again with it, but to a lower point than where they were taken up; and so the difference between their rise and fall with the pendulum constitutes the impulse, which is (or should be) constant and independent of all variations of force in the clock. Moreover, the pendulum has always, in some way or other, to unlock the scape-wheel, which is locked at every beat by one of its teeth resting on stops fixed to the pallets, or some equivalent arrangement; and it is essential that the friction of this unlocking, or rather any possible variation of it, should be so small as to be insensible to the pendulum. And it is still more essential that the scape-wheel should not be liable, in any possible natural state of the clock, to *trip*, *i.e.*, to jerk away the pallet it is lifting, so that several teeth pass at once; nor even to hold up the pallet higher than the proper point for the pendulum to take it up.

I am not going to write here on gravity escapements in general, most of which have so unquestionably failed in some of the above conditions as to throw suspicion on them all; and Mr. Airy's well-known mathematical "demonstration" of the impossibility of their succeeding naturally increased it, till the fallacy of that demonstration was discovered by a barrister, the late Mr. J. M. Bloxam, and also practically refuted, both by his gravity escapement and by several forms of mine, as Mr. Airy himself has acknowledged. The only two classes of escapements that I have to treat of now, are those which have the common property of a scape-wheel with a few long teeth for locking, and a few very short ones, or pins near the centre, for lifting the pallets; but subdivided into those which have a large enough motion at each beat to admit of being controlled by a fan-fly on the arbor of the wheel, and those which have not. The latter class is represented by Mr. Bloxam's nine-legged escapement; the former, I believe it has never been denied, are mine. Both on account of the number of the teeth and priority of date, I will begin with Mr. Bloxam's; but as a figure of that is given in the "Rudimentary Treatise" (p. 124), and I do not want to repeat what may be found there, I will give here a seven-legged escapement on the same principle, which will serve to illustrate them both.

The pallets A S, B S, in all these escapements, are placed on the principle of the one which is struck upwards, A S, making a right angle with the tooth which then rests upon it; and in all but Fig 3, the other pallet B S does the same when it is lifted. The wheels all turn to the right, and all the pendulums P are at this moment moving to the left, and just going to lift that pallet, A S. The theoretical centre of the pallets S, is at the top or bend of the pendulum spring; the actual pivots and arbors are as close by the side of S as they can be placed, so that there is no sensible friction at P. Q Q are banking pins for the pallet to rest against, without pressing on the lifting pins when they are down, so that the clock may more easily begin to lift; just as the striking wheel of a common house clock generally requires to have a little run at the hammer tail before the pins begin to lift it. The distance of centres of the wheel and pallets we will call d throughout; and the distance of the faces of the stops from S, or the length of the pallets, p, and the radius of the scapewheel r.

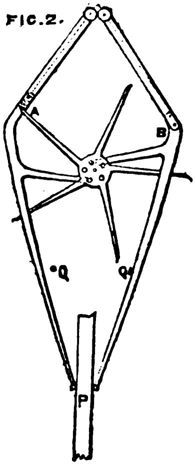
FIG. 1.



In the seven-legged escapement you will find that $d = 2{\cdot}24r$, and $p = 2r$; in the nine-legged $d = 3r$, and $p = 2{\cdot}28r$. The pressure and friction on the stops decreases with the number of the teeth, though not quite in that ratio, because this pressure is partly relieved by that of the pallets upon the wheel through the lifting pins. Therefore, both on this ground and the proportions between p and r, the friction of unlocking will affect the pendulum more in the nine legs than the seven. Mr. Bloxam, no doubt, had some reason for preferring the nine, but I do not know what it was. His own clock performed very well, but it required such delicate work, and such a fine train of wheels, that I believe no second specimen has been ever made, unless we are to except a small turret clock, which was stated to be got up for the late Exhibition under the superintendence of Mr. Airy, but was withdrawn before it had been there a fortnight, and not too soon. I do not know that the seven-legged escapement has ever been tried, nor do I suppose that it would differ so materially from the nine, as to be fit for ordinary use.

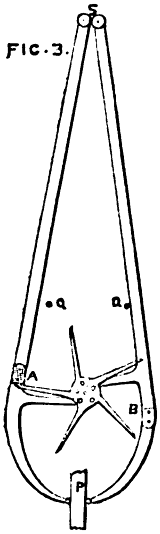
The next in numerical order is a five-legged escapement on the same principle, of which Fig 2 will give a sufficient explanation. The pallets are now still shorter, p being $= 1{\cdot}37r$, and $d = 1{\cdot}73r$; and the motion of the wheel is so much greater, that the velocity can be controlled by putting a fly of moderate size on the arbor, which was first done in my three-legged escapement in 1852. But still the fly, unless it is very large, is not enough resisted by the air to make this escapement safe from tripping in large clocks, where there must generally be a considerable surplus force to make sure of driving the train and hands in all weathers, temperatures, and states of the oil. For that reason we rejected it for the Westminster clock, though it is more tempting in appearance than some others which are superior to it in reality. Even a four-legged escapement, where of course the fly has more control, was found not safe

FIG. 2.



enough, and was changed into another form of three legs, which I shall speak of presently. I have seen this five-legged escapement with short pallets, apparently acting well enough in a small clock, of the common domestic size, though even for that I think the four-legged escapement better, on account of the greater control by the fly, and its requiring less careful work and adjustment.

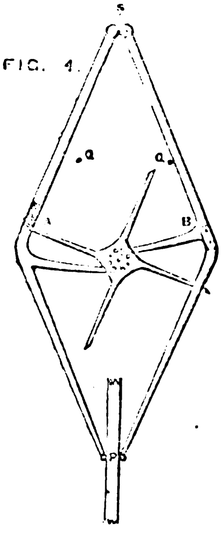
FIG. 3.



The five-legged escapement has been made (but under no advice of mine) in another form, corresponding to that of the original three-legs, for which this figure (3) will serve as well, if you assume the teeth to be 120° apart instead of 72°. Instead of the pallets embracing one tooth-space less than half the wheel, as in all the previous escapements, the stops are now opposite the ends of a nearly horizontal diameter; the up stop A being rather above the centre, in order that that pallet may make a right angle with the tooth, or it will trip; and the down stop B as much below, because if it is not, the beats will be unequal; but, on the other hand, if it is much below the level of the up stop, the unlocking will have a scraping action, which increases the friction, already large enough. For this construction requires the pallets to be very much longer in proportion to the wheel than in the other escapements, and therefore the effect of the friction at unlocking is so much greater on the pendulum: d and p can hardly be less than $= 6r$. And the pallets, hanging nearly vertical, have a greater dead weight resisting the pendulum at each impact in proportion to their effective weight required for the impulse; and this diminishes the arc; and the errors of every escapement vary inversely as the cube of the arc (other things being equal). The same position and momentum of the pallets also increase their liability to trip, even with a three-legged wheel; and a five-legged one is quite unsafe, except with a fly of inconvenient size, and the pressure on the stops is still greater. Therefore, the three-legs in its original form is imperfect, and a five-legs with long pallets is by far the worst of all this class of gravity escapements.

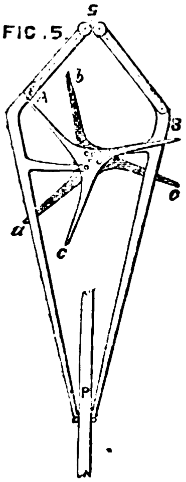
Some of its defects may certainly be met by the addition of a train remontoire, to cut off the variations of force before they reach the scape-wheel, as was done in the clocks with this escapement in the Exhibition. But that is only making two remontoires in the same clock, which is well enough for making a show of elaborate machinery, but is exactly the opposite of the true object of all scientific improvements, to produce better effects with simpler machinery. To say that a remontoire escapement will answer if another remontoire is added, is to confess that it fails in the primary conditions of such an escapement, and is, in fact, useless; for a dead escapement, kept clean and oiled, with the help of a good train remontoire, not encumbered with unnecessary friction, will go as well as any gravity escapement. One of the chief objects of these fly gravity escapements was to get rid of the necessity for train remontoires in large clocks required to go accurately; for they are not only rather expensive, in their cheapest form, but by no means safe things to leave in the hands of such persons as usually have the care of turret clocks. I have known two deliberately destroyed, probably because the workmen had put them wrong, and could not put them right again.

FIG. 4.



All the escapements hitherto described have an odd number of teeth; and so they must if all the lifting pins are on one side of the wheel; for the pin which has just lifted its pallet must be as much in advance of the vertical diameter as the pin that is going to lift is behind it. But a four-legged wheel will do as well, if you have two sets of pins, four of them pointing forwards, and acting on one pallet B, which stands before the wheel, and four others in intermediate places, acting on the other pallet A, behind the wheel. The stops also are on opposite sides, the B stop behind its pallet, and the A before it. This too has the incidental advantage of letting the pallet arbors go closer together at S. Here $d = 2·6r$, and $p = 2·4r$, which are convenient sizes for a wheel of 1¼ in. radius, and a clock of the usual regulator size. The pins in a wheel of this size should be one-eighth of an inch from the centre, to produce the proper lift. The motion at each beat, 45°, gives the fly quite sufficient control for any possible variation of force and risk of tripping in a small clock, though hardly in a large one. The fly should be as light as possible, and is best made of aluminium, or at least of very thin steel. Other details of construction and arrangement of the train for this escapement will be found in the "Rudimentary Treatise," but I had not then sufficient experience to be able to speak of its performance. I can now say, from other experience besides my own, that it answers extremely well in regulators, and in one respect better than the double three-legs (to be described presently), which is superior to this for large clocks. For when the scape-wheel turns in only six seconds, its pinion has to be so small that more force is lost in friction than any one would imagine who has not tried it. The weight of the double wheel also wastes some force in a small clock. I know two clocks which have been altered from the original three-legs to this, and they now drive a pendulum of 40 lbs. with a smaller weight than they required before for one of 15 lbs. This escapement requires no delicacy of construction, and pinions of 10 are quite sufficient, when they are good ones. Mine had to be sent back three times to Clerkenwell, before we could get a train fit to use. Such is (or was in 1861) clock-making machinery in London.

FIG. 5.



The defects which I have mentioned in the single three-legs (though I hear of some of these clocks going wonderfully well) are all removed by setting two scape-wheels on the arbor, far enough apart for the pallets to lie between them. The three lifting pins are also between, rivetted into both wheels. The stop on one pallet is in front of it, to catch the forward wheel, and the other behind to catch the back wheel. A full description of this escapement is given in in the "Rudimentary Treatise," as it was made for the Westminster and Leeds Town Hall clocks three years ago, and since in many others; so I shall not repeat it here. It must be observed that it has one quality distinct from all the other escapements, viz., that you may make p the length of the pallets, and therefore the resistence to unlocking, as small as you please, because the relative position of the wheels is arbitrary. If they are placed with their teeth equi-distant, or 60° apart, as at p. 134 of the "Rudimentary Treatise" (which is, on the whole, perhaps the best arrangement), d evidently $= 2r$ and $p = 1·73r$. In this drawing the teeth $a\ b\ c$ of the following wheel are set 90° behind those of the leading wheel A B C, and therefore $p = r$ and $d = 1·42r$. The pins must always be so set that the two nearest to the locking tooth are on a vertical line, and the third on a level with the centre, and they should not be farther from the centre than about $\frac{d}{40}$, which is a reason against making d very small. In turret clocks, with 5ft. pendulums, the scape-wheels are generally made of 3 in. radius, increasing up to 5 for 13 ft. pendulums. The pressure or friction on the steps is so small that, in the Westminster clock, driving about two tons of dial work and pendulum, no difference at all could be measured in some little weights hung by a thread, so as just to lift the pallets, whether the wheel was pressing on them or not. If it had a dead escapement of the usual kind, the pressure on the pallets would be at least 4 lbs.

I should have thought it superfluous to mention that the faces of the stops should be made flat or dead to the teeth, or at the most, only sloped enough to counterbalance the friction (which is almost less than you can see) if I had not seen some of these gravity escapement clocks made with rounded stops; which just defeats the primary condition of a gravity escapement, inasmuch as it allows the wheel to give an impulse to the pallet, while the pendulum is lifting it. I have put no banking pins for the pallets in this escapement, because it is only intended for large clocks, which have always a superfluity of force arriving at the escapement, beyond what will merely lift the pallets. This escapement has also been accidentally proved to have an advantage which I did not expect: the fly springs had been left loose after some alteration of one of the largest of these clocks, so that the fly was really doing nothing for it; and yet when it was next looked at it was found to have gone correctly without ever tripping. Not that I recommend the omission of the fly, although it is satisfactory to know that no harm will be done if it should get loose by neglect; for every remontoire, either in the escapement or the train, has an unpleasant bang without one, which is always tending to knock the machine to pieces. The secret may now be let out, that the original gravity train remontoire of the Royal Exchange clock, so highly commended by Mr. Airy in a published report, was quietly tied up for several years, on account of the concussion which it caused, until the late Mr. Dent replaced it, at his own expense, with the spring and fly remontoire, like that in his 1851 Exhibition clock, now at the King's Cross Station, of which the rate has never yet been excelled.

Several plans have been proposed for unlocking the wheel by the falling instead of the rising pallet, for the purpose of making it more secure against tripping. The neatest of them is that of turning the points of the teeth sideways, so as to let the stops slide away under them. But when you have once got an escapement absolutely safe from tripping in any possible state of the clock, it is hardly worth while to alter it into one rather more troublesome to construct, for the merely theoretical advantage of making it safer still. If this were all, to be sure nobody could object to it; but it is not all by a great deal; for if you unlock by the falling pallet, you will have the friction on the stops acting, not merely through a very short arc, and in one direction only, but first forwards and then backwards, through a large portion of the whole swing of the pendulum, both up and down; in fact, exactly corresponding to the dead friction in a dead escapement. I cannot help suspecting that all the proposers of these plans (and the principle of them is much older than this class of gravity escapements) have forgotten that the pendulum feels any friction on the pallets quite as much while they are driving it, as while it is lifting them, and that the pendulum really does the unlocking quite as much in one case as the other, but on their plan with all this extra friction into the bargain. As if that were not enough, in one of these clocks, which was exhibited, the pallet centres were put at a considerable distance both from the line and the top of the pendulum, which just introduces another friction between the pendulum and the pallets, which is carefully avoided in every other escapement in the world. I cannot conceive for what object that was done, except to give an appearance of originality, for which adopting a plan rejected by everybody else is not a bad *recipe*. For the same reason, I suppose, the fly was omitted, at the cost of a recoil which seemed to thrill all through the clock. Possibly too, the same explanation may account for that strange adoption of the worst kind of five-legged escapement, by an exhibitor of some very well-made clocks in other respects, from whom I have a letter saying, he considers the double three-legs "the *ne plus ultra* of escapements." But that was sure to be exhibited by other people, and was already well known as the escapement of the Westminster and other great clocks.

It may be convenient to some readers to have a summary of this review of these different forms of the gravity escapement.

1. The nine-legs and seven-legs are unfit for common use, on account of the delicacy of construction and uniformity of force which they require; and a fly can help them very little.

2. The five-legs with short pallets (Fig. 2) admits of being controlled by a fly sufficiently for small clocks with little friction in the train; but it is less so than the four-legs, and requires more careful construction.

3. The five-legs with long pallets (Fig. 3) is in every respect the worst of all the fly gravity escapements; having the greatest friction at unlocking, the least control by the fly, the most liability to trip, and the dead weight of the pallets and their resistance to the pendulum not exceeded in any other escapement.

4. The single three-legs is open to some of the same objections, though by no means to the same extent.

5. The four-legs is probably on the whole the best for small clocks, and certainly acts very well in them, and keeps an unusually steady rate; but it is hardly safe for large ones, without a fly of inconvenient size.

6. The double three-legs, made as described here or in the "Rudimentary Treatise," or in any proportion between those, is decidedly the best of all for large clocks, having the least friction, the greatest control by the fly, and being safe even if the fly should fail, and requiring the least delicacy of construction; in fact, much less than a dead escapement. It is now used almost exclusively by some of the best makers of turret clocks; and therefore anybody who chooses to require it can do so without losing the benefit of competition. Or, if people would only stipulate that their clocks are not to be fully paid for until they have gone six months, without ever varying more than five seconds a week, which is more than they ought to vary (not 5 minutes, as I saw in an absurd specification lately, fit for 150 years ago), that and the competition in price would soon settle what escapement is to be adopted by clockmakers who still refuse to alter their old patterns, or who make clocks as if they had steam engines to drive them.

These remarks are written for the information of those who like to avail themselves of it, and not to introduce a controversy, as letters on horology generally do: if anybody else introduces it, I shall not follow him. To any one who wants further information, beyond what is contained here and in the book referred to, I shall be glad to give it whenever I have time.

I am, &c.,
E. B. Denison.

33, Queen Anne-street, Feb. 2, 1863.

PHOTO-ZINCOGRAPHY.

Sir,—My attention has been directed to a review of Capt. Scott's work on Photo-Zincography, in your number of the 23rd ult., wherein you state that I am reproducing the first folio edition of Shakspeare's plays at the Ordnance Survey Office. This statement is not strictly correct. It is true that I have expended a great deal of time and a considerable sum of money in endeavouring to reproduce the folio in question, by photo-zincography, at the Ordnance Survey Office. But having been denied permission to exercise the personal supervision of the work, which is essential to its accuracy I have withdrawn it from that establishment altogether.

I am, &c.,
Howard Staunton.

Gossip.

New Iron Sheers in the Southampton Docks.—A number of gentlemen, including the chairman and other directors of the company, assembled in the Southampton Docks yesterday (Wednesday) afternoon, for the purpose of witnessing the tests applied to the monster iron sheers just erected for the company under contract, by Messrs. Day and Co., of the Northam iron works. They are of the following dimensions:—Length of the front legs, 110 ft.; length of the back leg, 140 ft; power of the engine to work them, 20-horse power; proof strains to be 100 tons vertical lift, and 80 tons with an overhang of 35 feet from the dock wall. The whole of this work has been successfully carried out under the superintendence of Mr. Alfred Giles, the Dock Company's engineer. The enormous bundles of rail iron, forming the testing weights of 100 tons, were raised from the railway trucks, which run under the sheers, and deposited on the quay; after which 80 tons were lifted and run out 35 ft. from the dock wall, and brought back again in a remarkably quick and satisfactory manner. This is effected by an improvement introduced by Mr. Thomas Summers, of the above-named works, in the construction of sheer-legs, which renders them simpler and easier to work than those on the ordinary plan. In the new sheers the back leg is made to act both as a prop and a guy to the front legs, and its bottom end slides in an iron groove strongly bolted to its foundation. The movement of the back leg along this groove is effected by a powerful wrought-iron screw, 43 ft. long and 8 in. diameter, and worked by the same steam-engine as is used to work the hoisting gear. The length of the groove is 48 ft., and the sheers are run either in or out in about four minutes. The rate of hoisting for weights up to 20 tons is about 12 ft. per minute, and for heavier weights a more powerful purchase is used, giving a rate of from four to six feet per minute. It is believed that no direct lift of 100 tons has ever been made before by one apparatus.—*Times.*

Compressed air in shells is about to receive a trial at Chatham. The elasticity of compressed air augmented by heat, as in concussion, is said to be awfully explosive. It is, if we remember rightly, the cause of earthquakes in all tropical climates.

Mr. James Bruce writes to say that the deficiency of fresh leaves, the only *remora* that impedes the noble enterprise of rearing silkworms, may be obviated by steeping sheets of paper in infusions and decoctions of the mulberry seeds, bark, stems, roots, &c., with the addition of a little gum to preserve them. These insects devour them as greedily as the fresh leaves. Mr. Bruce adds that the *Great Sea Mussel* forms a thread more valuable than silk itself, of which the *Sicilians* formerly made stuffs of incomparable beauty, a secret now forgotten.

Ventilation of Apartments.—The Academy of Sciences, Paris, has received an interesting paper by General Morin, on the ventilation produced in apartments by fire-places. The room of the director of the Conservatoire des Arts et Metiers was chosen by him for his experiments. This room may be heated at pleasure, either by a fire in the fire-place, or by a mouth of the calorifere of the establishment. Experiments were first instituted to ascertain the volume of air evacuated by the fire-place by the mere action of the difference of temperature of the outer and inner atmosphere. This natural ventilation was found to be on an average 400 cubic metres of air per hour, when the outer temperature was between 1·8 and 10 deg. centigrade (35·3 and 50 Fahr.), and the inner temperature was between 18 and 22 deg. centigrade (64·4 and 71·6 Fahr.). Hence this room is sufficiently ventilated by the mere aspiration of the chimney, even when, instead of one person, it contains, as it sometimes happens, ten or twelve. Direct experiments afterwards showed that the mouth of the calorifere introduced 150 cubic metres of air at 20 deg. centigrade per hour (68 Fahr.), when the temperature of the calorifere was between 70 and 100 deg. centigrade (158 and 212 Fahr.); but when the temperature of the calorifere was 45 deg., it only furnished 123 cubic metres. The quantity of air thus introduced through the interstices of two windows and two doors was found to be 246 cubic metres per hour. The fire-place drew from 1,200 to 1,300 cubic metres of air per hour, the amount of wood consumed being 8·26 kilogrammes per hour. The same quantity of air was drawn when the fire consisted of coal, the quantity burnt being 4 kilogrammes per hour. From these experiments it appears that nearly the whole of the warmth produced by combustibles in an apartment is carried off through the chimney, and the only useful part of it is obtained by radiation.

Bees.—The *Agriculteur* contains the following remarks on these singular insects:—Bees do not pass the winter in a state of stupefaction, nor do they sleep much longer during that season than in any other; all that depends upon the work they have to do. There are at all seasons some working bees alive and active in a hive, and at the same time when provisions are being got in, there are many at work day and night without taking any sleep at all. Their slumber is very light at all times, for they sleep with their eyes open; the slightest noise, a vivid light, or a current of air, is enough to awaken them; but the warmer the hive is the easier it is for them to sleep. Hence they consume much less honey in a hive situated in a quiet place, little exposed to light and air, than to one more exposed. But if the outer temperature rises very high, this favours the laying of their eggs, and then a larger quantity of honey is consumed. It is, therefore, easy to explain why in bee hives placed close to each other the consumption of honey is different during winter; and this is a circumstance not to be neglected, because colonies, which before winter seemed to have provisions enough to last them all through the month of March, may be reduced to extremities before the month of January, in which case the apiculturist must come to their assistsnce. If the bees have been able to enjoy an excursion or two since Christmas they will easily partake of the liquid food which may be offered them in a cup placed inside the hive; but if not, the food so administered may cause dysentery. To avoid this honeycombs full of honey should be cut out of other hives where the supply is plentiful, and transplanted into the needy ones. This delicate operation is performed in a cellar, by the light of a lantern, and with the aid of smoke. The colonies thus assisted must be left in the cellar, if it be not too damp, until a fine day comes, to allow of their flying out a little. The hives from which the honeycombs have been taken must also be left in the cellar for twenty-four hours at least, during which the bees feed on the honey that has exuded during the operation.

Mr. William Camper, the eminent ship and yacht builder, of Southamptom, has disposed of his business to Mr. Benjamin Nicholson, who has acted as foreman to him for a number of years.

An application has been received by the Mersey Docks and Harbour Board from the Private Telegraph Company for permission to construct two towers, one on either side of the Mersey, for the conveyance of the telegraphic cable across the river; the board to have the use of two wires, on consideration of the company being allowed to conduct their wires along certain parts of the dock estate.

The report of the Clifton Suspension Bridge Company states that the obstacles to the commencement of the bridge having been overcome, operations have commenced, and will be vigorously prosecuted. In accordance with the agreement with the Charing-cross Railway Company, the first instalment of £2,500 for the chains and other ironwork of the Hungerford-bridge has been paid and possession taken. The chains are now being unlinked, and will in due course be transported to Clifton. The report of Messrs. Hawkshaw and Barlow, the engineers, states that the preliminary operations at Clifton were commenced in November last. The preparation of the scaffolding and suspended platform at Clifton, and the manufacture of the additional chains, will proceed while the chains from the Hungerford-bridge are being taken down, measured, and arranged for re-erection at Clifton.

A large number of Messrs. Brown and Lennox's anchors, intended for the "Caledonia," and other iron-cased ships of war, were yesterday tested at Woolwich. The weight of each anchor averaged 5 tons 12 cwt., and the maximum test amounted to 72 tons.

At the meeting of the Mersey Docks and Harbour Board, on Thursday week, the special committee on plans for new works submitted for adoption a report (with plans) from the dock engineer, as to certain alterations proposed to be made in the intended scheme for the corn warehouses at the Prince's Basin, and the alterations at the said basin, involving an additional cost of about £36,500. Mr. Brocklebank said that the first feature was the enlargement of the entrance into the Prince's Dock Basin from 50 ft. to 65 ft. The next was the enlargement of the entrance into Waterloo Dock from 40 ft. to 45 ft. wide, with an alteration likewise in the position of the entrance, which he thought would be a very considerable advantage. The canal to the south of the Waterloo warehouses was enlarged from 100 ft. to 140 ft., giving sufficient space for two vessels to lie, one on each side, leaving a passage through the middle. These were the main features of the alteration in the Prince's Dock Basin, the addisional cost of which would be something like £18,000. The warehouses were proposed to be built fireproof, and to be supported on iron girders, by which means there would be a great saving of room upon the quay floor. The total cost of carrying out the plans would be £328,314. The engineer had now under his consideration some improved machinery, by which it was expected that the warehouses would be worked at a minimum of cost, seeing that it would both take the grain out of the vessels, and likewise distribute it through the various rooms without, he understood, much manual labour. The proceedings of the special committee were confirmed.

With reference to the utilization of town sewage (says a contemporary) a suggestion has been thrown out which appears worth attention. We are told that the fertilizing salts contained in the sewage are mixed with such an enormous quantity of water as to be comparatively valueless. But it is thought that the new chemical process of dialysis, discovered by the Master of the Mint, might be used on a great scale for the separation of the salts. The essential elements are there in the form of crystalloids and colloids, and it is for practical chemists to decide whether by the application of dialysis a question of so much importance can be settled.

A new Petroleum Trading Company is announced, with a capital of £100,000 in shares of £10 each. The object is to import petroleum from the natural wells in America in iron tank vessels specially constructed, which vessels will class A 1 for seventeen years. By this proceeding a large percentage will will be saved in freights. The demand for petroleum is yearly increasing for lighting purposes, and it is a cheap and efficient agent for the rapid generation of steam. The company possesses an able manager and a respectable direction; and it seems to promise considerable commercial success.

The Sewage Question.—A contemporary says that with reference to the utilization of towns' sewage (a much-debated question), a suggestion has been thrown out which appears worth attention. We are told that the fertilizing salts contained in the sewage are mixed with such an enormous quantity of water as to be comparatively valueless. But it is thought that the new chemical process of dialysis, discovered by the Master of the Mint, might be used on a great scale for the separation of the salts. The essential elements are there in the form of crystalloids and colloids, and it is for practical chemists to decide whether by the application of dialysis a question of so much importance can be settled.

Attachment to Carpenters' Jointers.—Mr. J. S. Dutton, of Jaffrey, U.S., suggests that carpenters should attach a guide to their long jointers, so that the frequent use of the try-square may be avoided. This he thinks will much facilitate operations, as the workman can rely upon the guide, where before he depended wholly upon his skill in securing a square face. "The guide should be made," says Mr. Dutton, "in the following manner:—Take a strip of hard wood, about two in. wide, 1 in. thick, and 3 in. longer than the jointer; joint this piece true, and fit one edge of it to the face of the jointer near the left hand side; it will cover about one-third of the face. This is the guide; in this position it must be fastened to the jointer, but so that it can be easily and quickly removed. One of the most simple modes of fastening is this: take two pieces of wire, each about 3 in. long and three-sixteenths of an inch in diameter, and fit these firmly into the edge of the strip, one near each end, leaving about one-half the length of the wires projecting outward. Make two corresponding holes in the face of the plane for these wire pins to enter; let the guide be well and tightly fitted at right angles with the face of the jointer, and project 1¼ in. beyond it at either end, to facilitate its removal. By this mode of fastening, the guide can be removed or replaced in a few seconds of time, and no injury result to the plane."

Parliament House, Edinburgh.—The *Scotsman* says that the suggestion recently made for the decoration of the walls of the Great Hall in the Parliament House, by hanging thereon the portraits, scattered through various parts of the building, of judges and other eminent personages, was on Monday carried into effect. The east wall is now tolerably well clothed by these portraits, and the improvement in the aspect of the hall is very marked. They have been hung with much care and taste under the superintendence of Mr. Charles Robertson, Treasurer to the Faculty, the larger and the smaller pictures being judiciously alternated and adapted to the nature of the spaces as these are broken up by doors, niches, and statues. There is room for many more, and no doubt time will add to the collection, for a painting thus conspicuously and appropriately placed is a scarcely less honourable or worthy memorial than a statue. The colour of the walls is rather too light to show the paintings to the best advantage, but this can be considered when they again require painting. The windows are the features most in need of alteration. If the great window, now so glaringly ugly, were refilled with really fine stained glass, and the side windows similarly treated, the hall would assume something like the appearance its noble proportions and grand roof well entitle it to do.

Filth and Fever.—In the last return of the Registrar-General, we find, among the notes of the district registrars, this social picture:—*Northallerton (Yorkshire).*—Births, 61; deaths, 39. Births and deaths are above their averages. Fever of different forms, and whooping-cough, are very prevalent in several parts of the district. The sanitary condition of this district is in anything but a satisfactory state; drainage is very bad, and heaps of putrifying filth are allowed to lie close to the dwellings of the poor. I particularly refer to the village of Brompton, where for some time synochus, typhoid fever, and typhus have been very prevalent. Here I find no drainage at all, no proper cesspools; yards unpaved, and dungheaps unremoved; the floors of the dwelling-houses beneath the level of surrounding land; and, what is still worse, the inhabitants appear to have a dread of ventilation. For years this village has been little else than a hotbed of fever, but this fact has not induced the authorities to adopt means of prevention. The mortality of children is excessive. Many infants are, when a few weeks old, left to the care of mere children, going for days without their natural food, but fed on scanty and improper diet. They die literally from neglect."

Meetings for the Week.

Tues.—*London Inst.*, "On Animal Mechanics," by Professor Marshall, at 3 p.m.
Inst. Civil Engineers, Discussion—"Drainage of Dundee and Sewerage of Newport Monmouthshire" at 8 p.m.
Wed.—*Soc. of Arts*, "On the Best Means for Promoting the Growth and Improving the Quality of Cotton in India." By A. Nesbitt Shaw, late Collector of Dharwar, and Commissioner of Revenue for the Northern Division of the Bombay Presidency, at 8 p.m.
Geological Soc., 1, "On the Middle and Upper Lias of the Dorsetshire Coast, by C. H. H. Day, Esq. Communicated by R. Etheridge, Esq. 2, "On the Correlation of the several divisions of the Inferior Oolite in the Middle and South of England," by Harvey B. Holl, M.D., at 8 p.m.
London Inst., "On the Zoology of Warm-blooded Vertebrata," by C. C. Blake, Esq., at 7 p.m.
Thur.—*Royal Inst.*, "On Chemical Affinity," by Dr. E. Frankland, F.R.S., at 3 p.m.
Antiquaries, at 8.30 p.m.
Linnean, at 8 p.m.
Chemical, at 8 p.m.
Royal Soc., at 8.30 p.m.
Fri.—*Architectural Assoc.*, "Ventilation," illustrated by models, by G. B. New, Esq.
London Inst., "On the Chemistry of the Non-Metallic Elements," by F. Field, Esq., at 7 p.m.
Geological Soc., Anniversary Meeting, at 1 p.m. Annual Dinner, at 6 p.m.
Royal Inst., "Recent Discoveries at Jerusalem," by Rev. G. Williams, at 8 p.m.
Sat.—*Royal Inst.*, "On the Science of Language," by Prof. Max Muller, at 3 p.m.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2017, 2037, 2058, 2079.
Boilers and Furnaces, 2342, 2060.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2014, 2020, 2045.
Ships and Boats, including their fittings, 2006, 2024.
Cultivation of the Soil, including agricultural implements and machines, 2028, 2030.
Food and Beverages, including apparatus for preparing food for men and animals, 2023.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2003, 2005, 2008, 2012, 2016, 2019, 2021, 2033.
Buildings and Building Materials, 2018, 2029, 2032.
Lighting, Heating, and Ventilating, 2001, 2025, 2026, 2027, 2034, 2052, 2054, 2056.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2010, 2011, 2015, 2022, 2038, 2040, 2041, 2043, 2055, 2068.
Metals, including apparatus for their manufacture, 2004, 2009, 2013.
Chemistry and Photography, 2044, 2050, 2062.
Electrical Apparatus, 2070.
Warfare, 2002, 2007, 2063, 2064, 2067, 2072.
Letter-Press Printing—*none.*
Miscellaneous, 2031, 2035, 2036, 2039, 2046, 2047, 2048, 2049, 2051, 2054, 2057, 2059, 2061, 2066, 2069, 2071; 2073, 2074, 2075, 2076.

2001. W. Bliss. *Improvements in heating ores, and in generating steam, and also in apparatus employed therein.* (A communication.) Dated July 11, 1862.

Here a blast furnace is used which is closed at its lower end by a valve or slide, so that after the process of heating or calcining the quartz or ores, the contents of the furnace may be discharged through an opening in the body of the furnace, which is closed by a valve or slide during the heating or calcining process. At the lower part of the blast furnace there is a hollow space all round, into which air, and the gases obtained from decomposed steam, are forced during the process of heating or calcining the quartz or ores. A steam boiler is employed in connection with the blast furnace, by the fire used for heating which a retort is also heated, and it is found convenient to arrange this retort so that it may form the bridge across the end of the boiler furnace, but the retort may be otherwise arranged and heated. By means of a fan or other suitable blowing apparatus air is forced into the hollow space at the lower part of the furnace, and passes through several openings from such chamber into the lower part of the blast furnace, and it is preferred that the air thus forced into the furnace should be heated in its passage from the blowing apparatus to the furnace, by causing it to pass through a pipe or pipes or passages heated by the fire of the boiler furnace, but the heating of the air may be otherwise accomplished. In the retort charcoal is placed, and steam from the boiler is caused to pass through and amongst such charcoal, and from the retort the gases and any steam which may not be decomposed pass into the space at the lower part of the blast furnace, and thence through the passages into the blast furnace. In working with this arrangement of apparatus a quantity of fuel is placed at the bottom of the blast furnace, and also the quartz or other ores requiring a like process; air and gases are forced into the blast furnace, by which a very high degree of heat is obtained. After a time it is preferred to stop the introduction of the air blast, and to continue the application of the gases till the process is complete. The air and gas pipes are protected by fireclay or bricks when using the apparatus for generating steam to be applied to work steam engines; and where no heating or calcining furnace is used, the gases obtained from the same are used in the steam boiler furnace. *Patent completed.*

2002. C. E. Green and J. Green. *Improvements in breech-loading firearms.* Dated July 12, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2003. J. P. Lees and J. Beard. *Certain improvements in carding engines.* Dated July 12, 1862.

This consists in an improved combination and arrangement of parts for regulating the set of the top flats of carding engines. Each end of each top flat is supported on a piece of metal or other suitable material, which is hinged to and capable of swivelling upon the rounded end of a screw, technically called the set of the card, being adjusted by two set screws passing through the swivel piece. The distance between the cards on the top flat and the cards on the main cylinder is regulated by the screw above referred to passing through the bend of the side frame, and a screw nut, and by a set screw entering into the end of the other screw. *Patent abandoned.*

2004. J. Abraham. *Improvements in presses for raising or shaping metals.* Dated July 12, 1862.

This has reference to the feeding into the press of the blanks to be raised, and the removal of the raised articles from the lower die. The inventor describes his invention in connection with a lever press worked by a lever handle. The blanks to be raised are fed to the press from a table a little higher than the level of the lower tool or die, and are pushed by hand from the said table to an inclined plane, down which they slide to the lower tool or die. The article raised is pushed from the lower die in the following way:—A nearly horizontal connecting rod, situate at about the level of the lower die, is jointed at one end to the vertical connecting rod which joins the treadle to the lever of the press, and at its other end to a lever fixed to the lower die. When the foot is lifted from the treadle, the horizontal connecting rod is restored to the horizontal position from which it had been displaced while the treadle was pressed upon by the foot, and, giving motion to the small lever on the lower die, pushes the raised article from the said lower die. *Patent abandoned.*

2005. J. Hunt. *Improvements in process of sizing and drying yarns or threads, and in the apparatus employed in such process.* Dated July 12, 1862.

This applies to what are known as tape-sizeing and slashing machines, and consists, principally, in opening, dividing, or separating the yarn whilst in a wet state, immediately after it leaves the finishing size rollers, and before it goes on, round, or over the drying cylinder or cylinders of the machine into two sheets or layers, or into as many sheets or layers as there may be back beams used in the machine. All these sheets or layers then proceed over the drying cylinder or cylinders of the machine. *Patent abandoned.*

2006. M. A. F. Mennons. *Certain improvements in vessels mounted as floating batteries.* (A communication.) Dated July 12, 1862.

The patentee claims the arrangement of fittings by means of which projectiles may be directed from below the water line against a corresponding point of the enemy's ship. *Patent completed.*

2007. T. Hill. *Improvements in the arrangements employed for the protection of markers at rifle butts, and in the means employed in indicating the score and position of the shot, and wiping out the shot mark.* Dated July 12, 1862.

The object here is for the better protection of the markers when engaged at rifle butts or targets, together with improved means of indicating the score and position of the shot upon the targets whilst the marker is in the act of wiping out the same. For this purpose, in order to protect the marker, a pit is sunk in front of the target, part of which is protected by a strong covering of iron plates or other materials. The covering of the pit nearest the target is to be, by preference, inclined, and has a sheet of thick plate glass inserted therein, in orded that the marker may see when the target is struck. On one side of the pit an opening is left, from which the marker can reach the face of the target, without any exposure of himself, in order to wipe out each shot mark in succession, and one part of the invention consists in using a series of brushes or instruments for this purpose, which in the act of wiping out, indicate to those at a distance the character of the shot mark, together with its exact position upon the target. *Patent completed.*

2008. E. T. Hughes. *An improved system of winding or rolling silk threads on moulds or bobbins, and placing them in suitable boxes.* (A communication.) Dated July 12, 1862.

Here the inventor winds, rolls, or plaits the thread in pellets, cylinders, or moulds, and also bobbins of various sizes, according to the purpose for which the thread is required. *Patent abandoned.*

2009. J. H. Johnson. *Improvements in machinery or apparatus for washing ores and minerals.* (A communication.) Dated July 12, 1862.

This invention consists in the employment of a long vessel filled with water, and fitted near the upper part with a trough slightly inclined towards one end; this trough receives the minerals to be washed. It has a vibratory motion communicated to it by means of an eccentric fitted on a shaft for that purpose. The trough likewise receives a rocking motion in a lateral direction. These combined motions cause the minerals to be separated according to their quality and degrees of fineness. The minerals are supplied to the trough by means of a hopper, into which a jet of water from a pipe is forced in fine streams. The bottom of the main vessel is furnished with divisions or apertures from which the separated and cleansed ore is removed. *Patent completed.*

2010. W. E. Gedge. *Improvements in the manufacture of hats.* (A communication.) Dated July 12, 1862.

Here the hat is made from felt prepared in the usual way, but of much lighter weight than ordinary, and is blocked to form, as is usually practised, except that care is taken to burn off with the blocking-iron all the hairs, and leave a polished surface. This form is then covered with three successive coats of gummy solution, each having been allowed to dry before the next is laid on; then a coating of varnish is applied all over, and the cloth or other material forming the outer covering placed or drawn thereon. *Patent abandoned.*

2011. P. Plassau. *An orthopædic apparatus to straighten again the stature.* Dated July 12, 1862.

This apparatus is, under one modification, composed of strong woven fabric, which is placed on the pelvis above the trochanters. This belt is made in two pieces, more or less closely brought together at the back by a couple of straps or a lace. The two anterior or fore parts of each of these pieces have eyelet holes or buckles, and thick pads are so placed inside the belt as to press on the inguinal region within the ilium, where the inguinal bandage is made to pass in cases of the hernia, so called. By this means the belt is prevented from turning and unpleasantly pressing or squeezing the hypogastric region. *Patent abandoned.*

2012. D. Bateman. *Improvements in the manufacture of "card cloth," used for carding wool and other fibrous substances.* Dated July 12, 1862.

Here the inventor makes card cloth of an admixture of linen and wool, the warp being linen and the weft of wool, or of woollen felt or woollen cloth, or a mixture of cotton, linen, or woollen cloth, and he treats the front surface of the card cloth with a composition which is impervious to the action or influence of oils or grease. He uses a mixture of one gallon of boiled linseed oil, four to six pounds of rice flour, half a pound of common glue, marine or other waterproof glue, and two pounds of gum, with which he treats or coats the front or both surfaces of the card cloth, and fixes thereto a covering of waterproof enamelled cloth, with the surface prepared with a mixture of one gallon of boiled linseed oil and one pound of lamp black for the first coats, and with boiled oil and yellow ochre, or other metallic or mineral powder for the finishing coats, and to give it the colour required so as to form a perfectly pliable and uniform surface. *Patent completed.*

2013. H. Barber and H. De Garrs. *Improvements in rolling iron, steel, and other metals, for cutting tools and other purposes.* Dated July 12, 1832.

This consists in rolling iron, steel, and other metals for manufacturing cutlery, tools, &c., so that the material when rolled shall vary in thickness across its width, so as to correspond with the varying thickness of the article for which it is intended. *Patent completed.*

2014. The Hon. W. E. Cochrane. *Improvements in railway fastenings.* Dated July 13, 1852.

Here, when using plates with studs or projections thereon, corresponding to the holes made in the ends of rails such as are usually formed for receiving screw bolts of fish plates, the plates are each so made that they have as many studs or projections as there are holes made in the ends of two rails, which is not new; but in place of making the outer surface of such a plate as heretofore, it is formed with a projecting incline on that part which comes within and below the top of the outer jaw of a joint chair, in which the ends of the two rails are to be fixed and retained by the plate. In addition to such incline there are two other projections formed near the upper part of the plate, so as to come, when the plate is in its place in the chair, on either side of the outer jaw of the chair and near its top. These projections form stops, which prevent the plate and also the rails striking longitudinally within the chair. Between these two projections or stops there are formed projecting ribs, which do not extend so far out from the outer surface of the plate as the stops, and it is between these ribs that the wedge is driven. The plate, when it has been introduced between the ends of the two rails and the jaw of the joint chair, is fixed therein by means of an iron wedge, which is driven between the jaw of the chair and the projecting incline on the outer surface of the plate. The inner surface of the wedge and the projecting ribs are formed with grooves or notches, so that when the wedge is driven tightly in its place it may be prevented becoming loose by driving a nail down through one of the notches or grooves in the projecting rib of the plate, and in the inner surface of the wedge. *Patent completed.*

2015. E. Taylor. *Improvements in the manufacture of buttons.* Dated July 14, 1862.

This consists in a mode of fastening on buttons without sewing. The shank of the button is separate from the face, and is passed through a hole in the centre of the button, it having a head or other projection to prevent its passing through entirely. This shank is made of hollow tubing, or solid metal, or other material, such shank passing through the stuff to which the button is to be attached. The shank has a small metal or other plate put over it, which is to be pressed, rivetted, or screwed, so as to prevent its drawing through, also a raised shoulder or collar to attach or hold a second plate to press the material holding the button. *Patent abandoned.*

2016. G. Lowry. *Improvements in machinery for carding and cleansing cotton and other fibrous materials.* Dated July 14, 1862.

The first part of this consists in adapting a brush with an intermittent or continuous rotary motion, or with a reciprocating action, or a to and fro movement, during the working of the main cylinder of carding engines, together or in conjunction with a self-acting comb, which is cleared of the motes and other impurities by a perforated or recessed plate, or plain plate, or straight edge, and deposits the same into a trough or other suitable receptacle, whence they are removed as described in the specification of letters patent granted to the present patentee, bearing date Nov. 25, 1861 (No. 2954). The second part consists in making the main cylinder of carding engines with a flanged periphery projecting above the points of the wire clothing, to prevent the fibrous material escaping over the ends of the main cylinder. The third part relates to tow and waste shaking machines, and consists in placing the finger shafts at an incline, and at opposite sides of the machine, to which is applied a self-acting feed eloth or creeper, and a fan to carry off the dust. By this arrangement the material is continuously supplied and discharged, whereas in machines of the ordinary construction, the material is supplied in quantities, and removed when operated on by hand. *Patent completed.*

2017. W. E. Gedge. *An improved portable or stationery steam-lift and force-pump.* (A communication.) Dated July 14, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2018. A. A. Gannal. *Certain improvements in the manufacture of bituminous cement.* Dated July 14, 1862.

This consists in combining sandy earth, or, by preference, river sand, with a quantity of bituminous substance, equal in volume to the sum of the spaces between grains of well pounded sand. *Patent abandoned.*

2019. C. Crossley and J. W. Crossley. *Improvements in means or apparatus employed in washing and finishing textile fabrics.* Dated July 14, 1862.

This invention consists in passing fabrics through a "heck" and over rollers at an elevation, in order to undo the twists and separate the draughts. A cutter is attached to a washing machine called a "dolly," which enables the patentees to separate all the draughts of fabrics at one time. The second part of the invention relates to the calendering and watering of fabrics, by using three rollers, in such manner that the goods may be placed on and around the centre one, pressure being applied by means of levers or screws. The reversing motion of the driving apparatus is so arranged that the rollers can be driven in opposite directions, to produce a better finish to the goods than heretofore. The rollers may be heated or not, and paper may be used to assist in giving a gloss to the fabric. *Patent completed.*

2020. S. Partridge. *Improvements in railway signals.* Dated July 14, 1862.

This invention consists in arrangements of railway signals, whereby the driver and passengers of a train arriving at a signal may be informed of the time which has elapsed since a train or engine last passed the signal. The mechanical contrivances employed are a weight and pendulum and certain toothed wheels, whereby discs are removed from dials, which give the desired information. *Patent completed.*

2021. P. Sanderson and R. Sanderson. *Improvements in the manufacture of woven fabrics, and in the machinery or apparatus employed therein.* Dated July 14, 1862.

This relates to the manufacture of a particular kind of cloth suitable for wearing apparel. This cloth is woven so that, at regular intervals, a loop is formed on the surface of the cloth, which imparts a peculiar knotted appearance to the finished goods. These loops are formed at predetermined distances asunder in the width of the fabric, and at a regular distance longitudinally, by weaving a given number of shots of weft between each transverse row of loops. *Patent abandoned.*

2022. W. G. May. *Improvements in apparatus for extending tables.* Dated July 14, 1862.

Under one modification, this extending apparatus consists of a series of adjustable bars or laths, arranged and jointed together to form what is known as the lazy tongs movement, and admit of the table being extended or contracted, at pleasure, within the limits of the lever arrangement. To one end of the frame of the table is fixed a bracket-piece, to which are jointed two bars, or laths, that form the first of the series. These bars extend outwards to the width of the table. To the free extremities of the primary bars, or laths, are jointed two other bars, which are jointed at the centre, where they overlap one another, and are sufficiently long to extend quite across the width of the table in an angular direction. The free ends of these secondary bars are jointed in like manner to third pair, and so on until a sufficient number of pairs of bars, or laths, are connected together to obtain the required amount of extension. The series of bars, or laths, is completed by a short pair, similar to the first, which are jointed, in like manner, to a bracket-piece fixed to the framing at the opposite end of the table. A hand-lever is attached to one end of the bars, or laths, and is arranged so that it may be turned outwards, so as to project beyond the side of the table. By turning this lever in one direction, the system of bars, or laths, are caused to extend, and so carry the telescope framing of the table out to the full extent, or any desired portion thereof. *Patent abandoned.*

2023. P. A. S. Canonicat. *Improvements in filtering water, and in apparatus employed therein.* Dated July 14, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2024. G. Fawcus. *Improvements in building boats.* Dated July 14, 1862.

The object of this invention is the constructing of boats in such manner that any number of boats of the same size will fit one within the other. The patentee dispenses, if desired, with internal projections, and makes the thwarts to fold, and supports them by an iron upright when shipped. He employs flat, half round, or angle-iron or iron plates, to impart the necessary strength. *Patent completed.*

2025. F. M. Parkes. *Improvements in the manufacture of gas for lighting and heating, and in apparatus employed in the said manufacture.* Dated July 14, 1862.

This consists in the manufacture of gas by the combination of the gas obtained from petroleum or rock oil (which is also known by various other means) with the gas commonly termed hydro-carbon gas, or water gas. And further, in the peculiar apparatus or retort represented in the drawings. *Patent completed.*

2026. O. P. Drake. *A new and useful or improved apparatus for vaporizing and aerating liqiud hydro-carbon to be burned for illumination, or for other purposes.* Dated July 14, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2027. R. Ridley and J. Grafton. *Improvements in machinery and apparatus for ventilating mines and other places.* Dated July 14, 1862.

For the purposes of this invention, at the top of the upcast shaft of a mine, a hollow rotating apparatus is placed, which has an opening through its under surface, or through that surface which is next the mine, such opening being, by preference, of a diameter (as near as may be) corresponding with the diameter of the upper end of the upcast shaft. This apparatus consists of the under cover or end with the opening into it, and an upper cover or closed end to which an axis or shaft is fixed in its centre, which axis or shaft passes through the closed end, where it is put in motion by any suitable power; the lower end of the axis steps into and is supported by a suitable bearing, carried by a bearer or frame fixed across the upcast shaft. The upper end of the axis or shaft also turns in a suitable bearing outside of the apparatus, carried by a suitable beam or framing external of the apparatus, and fixed to the band above the upcast shaft. The periphery of the apparatus is not cylindrical, but is formed with openings (by preference four) in planes radiating from the centre of the apparatus; the circumference of the apparatus is closed, except at these openings, by four curved plates (if there be four openings or outlets), each of which plates springs from the inner end of one opening, and passes to the outer end of the next opening. Provision is made in the under surface of the apparatus, so that air may not pass from the outer atmosphere into the apparatus. The apparatus when in use is caused to rotate with considerable velocity, in such direction that the air, rising up the upcast shaft, is drawn into the interior of the apparatus, and flows out of the several openings. *Patent completed.*

2028. A. Lislik. *Improvements in apparatus for applying steam or other motive power to cultivate the soil and to actuate wheeled carriages.* Dated July 15, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2029. A. Couvreaux. *A centrifugal apparatus for breaking stones.* Dated July 15, 1862.

In carrying out this invention the patentee employs a large wheel, on which are rivetted plates, so as to form a series of paddles, and these are rivetted to angle iron, so that the whole is firmly fastened and made sufficiently strong. It works in a wooden frame, which also carries the bearings of the shaft or axle. Over this wheel, and inside the frame, he places a number of plates of strong iron, at such an angle as to enhance their strength, while at the same time they are so fixed to break stones or other earthy matter that may be thrown against them with great force at which the wheel throws them, and after being dashed as it were off at a tangent from the different teeth or paddles on the rim, they finally arrive on a shoot down which they slide into a heap and are ready for use. At the opposite side of the frame to this shoot there is a platform with an inclined board, down which the stones or other matters descend on the teeth or paddles of the wheel, which is driven by a strap from a steam-engine. *Patent completed.*

2030. J. Green. *Improvements in the method and means of producing signals, and in the application of the same, particularly to steam ploughs or cultivators.* Dated July 15, 1862.

This invention consists in employing and so arranging a wire or cord, composed of hemp or other material, that the ploughman and anchormdn are thereby enabled at any time to make signals to the man at the engine or windlass. In order to effect this, the patentee attaches one end of the wire to a drum or pulley, which is secured to the engine or windlass in a suitable manner. The other end of the wire is fastened to the anchor, or other suitable frame, fixed at another side of the field intended to be operated upon, consequently the wire is then extended from one side of the field to another. The plough or other implement connected with the wire by means of a rectangular shaped frame, having two loop holes or eyes, through which the wire is run; this frame is attached to the plough, and as that moves along, the loop holes or eyes slide along the wire, that being extended parallel to the track of the the plough. The wire is kept tight by means of a smaller pulley or drum acted on by a cord or weight, and as this pulley is fixed upon the axis of the drum before mentioned and is connected with the latter by means of a ratchet wheel and spring catch, it constantly tends to wind up or coil the wire round the larger drum. When the wire is pulled, a series of studs or pegs on one side of the drum to which it is attached give motion to a lever fixed on the frame, which communicates with a bell or whistle, or other signal. When the wire is let go the smaller pulley, by means of the cord and weight, brings back the drum to its former position, and thereby tightens the wire again. *Patent completed.*

2031. A. Couvreaux. *A centrifugal apparatus for throwing stones, earths, and other materials.* Dated July 15, 1862.

In carrying out this invention the patentee makes use of a large wheel, which revolves at a very high speed, and on which is placed a series of paddles or buckets; the stones are conveyed into the inside of the frame by means of a shoot, and are taken up by these paddles or buckets and thrown off at a tangent through another shoot, which can be elevated or lowered according to the distance they are required to be thrown. The whole is mounted on a wooden frame, and the wheel is driven by means of a pulley and strap from an engine or any other convenient motive power. *Patent completed.*

2032. E. Draper and E. Thomas. *A new or improved method of strengthening wooden shutters and doors.* Dated July 15, 1862.

This invention consists in the application of hardened and tempered steel or iron plates to doors and shutters as a means of defence against burglars. Also in hardening and tempering the said plates by pickling them in sulphate of potash, arsenic, rock salt, and water. *Patent abandoned.*

2033. W. Dickens and J. Hewitt. *Improvements in self-acting and hand mules employed in spinning cotton and other fibrous materials.* Dated July 15, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2034. C. E. Crawley and F. Foster. *Improvements in safety or miner's lamps.* Dated July 15, 1862.

This invention is applicable more especially to safety or miner's lamps in which a circular wick and burner are employed, and consists in combining a locking bolt with the apparatus which raises and lowers the wick, to increase, diminish, or extinguish the light. This bolt serves to lock the wire gauze in its place, and it is actuated by the same button which serves to regulate the wick. The same motion which lowers the wick withdraws the bolt, and the parts are so adjusted that the wick must be depressed sufficiently to extinguish flame before the wire gauze is set free to be removed. *Patent completed.*

2035. T. G. Ghislin. *Improvements in the treatment or preparation of British and foreign algæ, and the application of the same to various branches of the arts and manufactures.* Dated July 15, 1862.

This invention consisis in treating or preparing British and foreign seaweeds of the order *algæ*, so that they may be used for various useful purposes in the arts and manufactures. In carrying out this invention, the seaweed should be first steeped in dilute sulphuric acid for about three hours, and then well dried, so as to become hard, after which it is to be ground up or reduced to an almost impalpable powder. The dry powder is then to be mixed, in any convenient proportions, with the ingredients hereinafter named. The patentee first prepares a strong glutinous solution, composed of common glue dissolved in water, to which must be added a solution of india rubber, gutta percha, or other analogous substances. In practice, he finds the following proportions are convenient, viz.:—10 per cent. of glue, dissolved in water, 5 per cent. of gutta percha, and 2½ per cent. of india rubber, dissolved in naphtha, or other suitable solvent of these gums. To these he adds 10 per cent. of coal tar. These substances are all well mixed and boiled together. He then adds thereto, in a dry state, 5 per cent. of sulphur, 5 per cent. of rosin, and 2½ per cent. of alum, and, say, 60 per cent. of the pulverized seaweed. He carefully and intimately mixes the pulverized ingredients in the boiling compound, and, when the ingredients have been well incorporated, the mass must be submitted to heat in a suitable oven, taking care that the mixture be not heated above 300 deg. Fahr. The mass will then be brought into a plastic state, and may be moulded or embossed in the same way that gutta percha is now done, or rolled, pressed, stamped, or otherwise formed into any desired shape, and thereby adapted, when it becomes hard, for various useful or ornamental purposes. *Patent completed.*

2036. B. Johnson and E. H. Taylor. *Improvements in rope wheels, cages, and tanks used for mines, collieries, and other similar purposes.* Dated July 16, 1862.

The object of this invention is to afford the means of a ready adjustment of the length of the winding rope or chain between the rope wheel and the cage or article to which it is attached. On the shaft of the rope wheel, the inventor fixes a boss in two parts, each having a flange on the outside, so as to form between them a circular groove, into which is fitted the rope wheel in such manner that it may be turned upon the boss or upon the shaft when required, and afterwards bolted to the side flanges by bolts. In the side flanges, he drills, in a circle of a given diameter, a number of holes, and in the solid part of the rope wheel around the boss, he drills in a circle of the same diameter one, two, three, or more holes more than there are in the side flanges, so that the bolts employed for holding the wheel and boss together can be passed into different holes, and thereby obtains a very delicate adjustment of the length of the rope. Thus, when there is one hole more in the rope wheel than in the flanges, if two bolts have been passed through two sets of holes opposite each other, and then withdrawn so that the rope wheel can be turned to allow them to be passed through the next set of holes, the winding rope will be shortened a distance proportionate to a fractional part only of the circumferential distance between the holes, and if the rope wheel be turned to the next following set of holes, another fractional part will be added, and so on, the different numbers of the holes producing an effect similar to the use of the vernier in philosophical instruments. When the boss consists of one part only, the rope wheel is to be formed of two parts, in order to place it between the flanges; or the plan may be varied by having the wheel of one piece and one of the flanges moveable. *Patent abandoned.*

2037. G. T. Selby. *Improvements in apparatus for superheating in tubes and tubular articles, and in machinery for the manufacture thereof.* Dated July 16, 1862.

In carrying out this invention the patentee constructs superheaters of one or many tubes of a worm or spiral form, through which the steam or gas to be superheated passes; heat from the furnace is outside round about them. They may be placed in the funnel stack, fire or smoke-box of a steam boiler, or in any convenient part of a furnace, or in a furnace made for their reception. The tubes being spiral, expansion and contraction in the length of the tube are accommodated without affecting the joint or connection to the part where the tube is fixed. When many (or a series of) spiral tubes are required, he makes the connections between them of tubes formed for the purpose, with thicknesses of metal at that part where the joint is made. This thickness is of greater substance than the other parts, so that the joints may be effectually made, either by the ends of the spiral tubes being screwed in or otherwise. A similar extra thickness may be formed on the opposite part, in order that the whole may expand and contract more uniformly. This kind of tube is particularly useful in the construction of surface condensers, it being only necessary to provide a suitable thickness of metal at those parts where the joints and connections are made, the other parts of the tube being thinner. These thick-sided tubes or tubular articles are useful for many other purposes, particularly for bridge and roof girders, and for pillars. The machinery by which these tubes are made is somewhat similar to that which is used for making and welding iron tubes, but the dies used at the draw-bench for bringing the edges of the piece of metal together, preparatory to welding them, are shaped so as to allow the projections or thicker part of the metal strip or sheet to pass through when the desired form has been given to the thickness of the piece of metal, in the usual way, by grooves formed in the rolls of the rolling mill. When, however, the extra thickness is given, as hereinafter described, the tube or tubular article is prepared and welded in the usual way. When the tube is thus prepared it is placed in a furnace and brought to a welding heat, and then passed through rolls to weld the edges together. The inside should be supported by a mandril, such as is used for welding iron tubes, and the rolls may be a set of 2, 3, or 4, similarly constructed to those now used for welding iron tubes, with this difference, that on one roll, or on all the rolls, or on opposite rolls, a groove is made to correspond with the shape and thickness desired to be given to the outside of the tube or tubular article, and the mandril must be shaped to give the desired internal form and thickness to the tube or tubular article. But the patentee prefers to give the desired extra thickness by partially fixing, externally or internally, or both, either by welding at the ends, or by rivetting, a flat or suitably shaped piece of iron on an ordinary tube, and then passing the whole at a welding heat through grooved rolls, as above described, so as to weld the whole length of the piece or pieces of metal on to the tube. *Patent completed.*

2038. L. R. Bodmer. *Improvements in apparatus for winding up watches and other time-keepers.* (A communication.) Dated July 16, 1862.

These improvements relate to certain apparatus or mechanism for winding up the main-springs of watches and other time-keepers without the use of a key, by means of a chain, one end of which passes through the handle or knob of the watch, where it is secured to a steel pin with head, which fits into a socket of the watch knob or handle. The chain is wound round a grooved pulley, which latter fits upon a bush upon the square arbor of the main-spring barrel. Upon this bush is fixed a ratchet wheel into which takes a pall moving round a stud in the chain pulley. The chain pulley is provided with teeth on its circumference which gear into the teeth of a wheel turning loosely round a bush of a square stud fixed to the watch plate. The body of this wheel forms, or has attached to it, the barrel of a second spring, one end of which is fixed to the bush, and the other to the circumference of the barrel, in the usual manner. On taking hold of and drawing out the pin head of the chain which rests upon or fits into the watch knob, the pall on the pulley taking into the ratchet wheel carries round with it the main-spring barrel, thereby winding up the main-spring, and at the same time the second spring above referred to is wound up. When the hold on the chain is relaxed, this second spring will turn its own barrel and wheel, and therewith also the chain pulley, in the opposite direction, and thus again wind up the chain round its pulley, the catch gliding, during the latter operation, over the teeth of the ratchet wheel. A tappet actuated by a spring, presses the chain into its groove, and ensures its being wound closely coil upon coil on the chain end being released. *Patent abandoned.*

2039. W. Henson and W. W. Clay. *Improvements in knitting machinery, and in apparatus connected therewith.* Dated July 16, 1862.

These improvements have for their object the manufacture of looped or knitted fabrics in circular and straight frames. By means of these improvements the patentees produce a superior article with an increase in quantity to what has been heretofore produced in the same period of time. These improvements relating to the circular frame, and which are also applicable to the straight frame, are as follow:—Each head consists of an inner head, provided with a pipe at the lower end, which revolves in a boss cast on the frame of the machine, and bored truly out to receive the said pipe of the inner head. The lower end of the pipe projects through the boss, and is provided with a spur or bevel wheel gearing into a similar wheel on a shaft driven by hand or power. The upper end of the inner head is turned down and fitted with a ring, which projects somewhat beyond the head at the outside thereof. This ring is provided with the number of saw-gates required; in each saw-gate the upper end of a needle is free to slide up and down; the lower ends or stems of the needles are secured in the needle bits, which slide in saw-gates in another ring on the outside of the inner head, this ring lying below the ring first above mentioned. The ring first mentioned is secured to the inner head. The needle bits have a projection on the lower end on the outside; ther these projections take into a groove cut on the inner side of a ring; or a groove may be formed by (that is between) two rings secured to another ring lying outside them, so that by the revolution of the inner head the needle bits and needles will be alternately raised and depressed, the needles thus performing the well-known action, though actuated by the novel arrangement described. Instead of employing looped wheels to gain the loop, and a presser wheel to press the beards of the needles, the patentees use the following apparatus:—Outside the ring in which the needle bits slide is a series of projections in advance of the needle bits. This ring has as many saw-gates on it as there are needles in the head, and in each saw-gate is a lever which is somewhat bent at the upper end; the lower end is hinged or otherwise attached to the ring. Or the levers may be soldered in the saw-gates of the ring, and act as springs, the upper bent ends in either case being exactly opposite the beards of the needles, so that, as they rise up above the springs or levers, they are fed with a thread of silk, cotton, or other material, and as they descend, the bent ends of the springs or levers are pressed upon the beards, and hold them down close to the stems, to allow the previously formed loops to pass over the beards. The pressure on the springs or levers is obtained by the revolution of wheels or discs of metal supported by brackets on the outside of the frame. *Patent completed.*

2040. A. V. Newton. *An improvement in sewing machines.* (A communication.) Dated July 16, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2041. C. Sanderson. *Improvements in the manufacture of crinoline or crinoline steel.* Dated July 16, 1862.

The object of the present invention is to coat or cover the crinoline steel with a coating or covering of pulp produced from cotton, flax, or any vegetable or animal material which is capable of being converted into a pulpy state, and then solidified on the steel. *Patent abandoned.*

2042. R. Dunn. *Improvements in furnaces.* Dated July 16, 1862.

According to one part of this invention, it is proposed to make the fire bars tubular, and to construct them in two or more lengths, the tube of any one length being fitted so as to correspond with the tube of the contiguous length or lengths, with the view of forming a continuous passage for air from the front of the furnace to the bridge. The length next the bridge fits into a metal frame or chamber upon which the bridge when used is placed. Through, and at the back of this frame or chamber are (one or more) orifices, by which the air passing through the tubular bars makes its egress, and then mingles with the gases evolved from the fuel, whereby the combustion of such gases is caused. Another part of the invention consists in forming openings on the under sides of the tubular fire-bars, so as to admit air thereunto, which air will then pass along the tube even when the front portion of the bars has become stopped up. *Patent completed.*

2043. M. Kurts. *A new or improved material to be used in the manufacture of handles for umbrellas, parasols, and walking sticks.* Dated July 17, 1862.

The patentee claims the application of Jambees cane to the manufacture of handles for umbrellas, parasols, and walking sticks. *Patent completed.*

2044. J. Dickson. *Improvements in the manufacture of caustic soda and carbonate of soda.* Dated July 17, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2045. H. Appleby. *Improvement in armour plates for ships of war floating and land batteries, and other like purposes.* Dated July 17, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2046. G. Harkness. *An improved safety handle for winches and cranes, and other like machines.* Dated July 17, 1862.

The object of this invention is to prevent the handle of winches, cranes, and other like machines, from revolving with the driving shaft during the operation of "lowering," "paying out," or unwinding, as accidents frequently happen to persons employing such machines, by the great speed at which the said handles usually rotate. The lever and hand bars of the handle are of any suitable or usual form, but the aperture or eye near the end of the former is made of an oval or other suitable form, having length, and the driving shaft on which it is to be placed is circular. Forming part of, or attached to the handle at its extreme end, and just beyond the aperture or eye above mentioned, is a "catch piece." The drawing pinion or wheel, or other wheel fastened to the driving shaft (or, if there be no convenient pinion or wheel, then a disc fastened to the driving shaft), has two or more studs or pins cast or otherwise fastened thereon. When it is desired to raise a weight, say, by any machine of the class above mentioned, then the oval or other formed aperture or eye allows the handle to be moved sufficiently to bring the so called "catch piece" to bear on the sides of the said studs or pins, and thus make a purchase for the handle, which has power applied in the usual way. But when it is desirable to lower the weight, then the handle is moved in the contrary direction—that is, until that end of the aperture or eye nearest the end of the lever bar is close up to or on the driving shaft—and the catch piece no longer bears on the studs or pins, but it rests near the shaft within the circle described by the said studs or pins as they rotate with the shaft; the lever bar is made with a shoulder or bend sufficiently large to allow the said studs or pins to pass without coming in contact with it. *Patent abandoned.*

2047. J. Schloss. *Improvements in pouches.* Dated July 17, 1862.

This invention relates to india-rubber pouches, and consists, firstly, in forming them with a flap cemented at the edges to the sides of the pouch, and loose or unattached all along the front end of the flap. The pouch itself is narrowed towards the mouth, and, the flap being cemented to the edges, causes a spring-like action to keep the flap closed. The invention consists, secondly, in forming pouches with a single piece or flap in the form of a flat ring, cemented all round or at intervals to the edges of the pouch. To get at the contents of the pouch, the edges of the ring are turned back all round, when the mouth of the pouch is disclosed and opened. By turning the edges of the ring in the reverse direction, the mouth of the pouch is covered, and the contents prevented from getting out. *Patent abandoned.*

2048. T. B. Daft. *Improvements in the manufacture of mats and other surfaces where vulcanized india-rubber is employed.* Dated July 17, 1862.

In making mats or other surfaces having strips or narrow fillets of vulcanized india rubber, the strips are used, say, about three-quarters of an inch wide by a quarter of an inch thick, and laths of wood or other hard material, say about three-quarters of an inch wide by a quarter of an inch thick; these are nailed down upon a board, the wood and rubber strips alternately, the wood flatwise and the rubber edgewise, thus forming projecting surfaces of india-rubber or other elastic ridges of about half an inch above the strips of wood or other material. If wavy or undulating lines are desired instead of straight ones, the sides of the fillets or strips of wood are formed wavy, and the rubber strips are made to follow them. In making thick mats, which are sometimes preferred, having elastic ridges an inch or more in depth above the hard surface, strips of wood or other hard material, say one inch and a quarter by three-quarters of an inch, are prepared of a certain length, say three feet, and rubber strips are prepared the same length, and of a section, say about two and a quarter inches by a quarter of an inch; these strips of wood and rubber are to have holes of about half an inch diameter made in them about six inches apart, and in such a way as to allow rods of iron screwed at both ends being put through them, first a strip of wood and then a strip of rubber, finishing with a strip of wood, and having enough of each to make a width of about two feet; the holes are to be formed in the wood and the rubber respectively, so that the surfaces shall be even on the under side, but on the top side the rubber shall stand up edgewise above the wood about an inch; nuts are screwed on to the iron rods, and all made firm and tight. This arrangement makes a very effective mat or shoe cleaner, and when a strip is worn down or destroyed, it can with facility be replaced. *Patent completed.*

2049. T. B. Daft. *Improvements in the manufacture of vulcanized india rubber thread.* Dated July 17, 1862.

The india rubber used for this purpose is cleaned, ground, and mixed with a proper quantity of sulphur, to cure or vulcanize the thread made from the mixture when it has been subjected to the requisite process of heat. The sheet produced from this compound of india rubber and sulphur may be spread in the usual way in which sheets are made for the purpose of being vulcanized, and afterwards cut into thread, and which process of spreading is well known. Or it may be produced by simply rolling out the compound after it has been well blended and mixed, or otherwise suitably prepaed, which processes are also well known. A sheet of sulphurized india rubber, either spread or rolled to about the thickness of the diameter of the thread required to be made, is cut up into strips of the full length of the sheets, and of a suitable width for the apparatus. If the sheets be of great length, the thread will be in proportion; if short, the thread will be short also; but if very long lengths of thread are required, and it be inconvenient to spread sheets accordingly, or to roll them out of the requisite length desired, then one sheet may, in the sulphurized state, be readily joined endwise to another; and in this way, or by similarly joining the strips of a few inches wide endwise, the means of obtaining thread of any desired length will be obvious. India rubber compound, fresh from the spreading or rolling, is liable to shrink, particularly when the compound of india rubber and sulphur is of the best and purest materials, such as should always be used in the manufacture of thread; and it is preferred that it should be submitted to a setting, or seasoning, process. Time will effect this at ordinary atmospheric temperatures, but it may readily be done by submitting it to the effect of boiling water for a short period, according to the bulk of materials being operated on; or if water under pressure, or steam at 250 deg., or thereabouts, be employed to set it, a still shorter time serves to season, set, or shrink it. *Patent completed.*

2050. W. Gossage. *Improvements in the decomposition of chloride of sodium and chloride of potassium, for the production of compounds of soda and potassa.* Dated July 18, 1862.

The patentee claims,—1. The decomposition of chloride of sodium and chloride of potassium for the production of certain compounds of soda or of potassa, by causing such chlorides, or one of them, when in the state of vapour mixed with the vapour of water, and mixed with gaseous products of the combustion of fuel, to be brought into contact, at an intense heat with lumps or pieces of certain solid substances, in such manner as to provide for such mixture of vapours and gaseous bodies filtering or flowing through interstices existing between the said lumps or pieces of solid substances. 2. The construction of apparatus, which provides for chloride of sodium or chloride of potassium in the state of vapour mixed with vapour of water, and mixed with gaseous products of the combustion of fuel, being caused to filter or flow at an intense heat through interstices existing between lumps or pieces of certain solid substances contained in a tower or chamber, as described. *Patent completed.*

2051. J. Willcock. *A new ornamental fabric, and the machinery for producing the same.* (A communication.) Dated July 18, 1862.

The subject matter of this invention relates, 1, to the manner of forming or making a new manufacture, to which the patentee has given the name of amosine braid, which is designed to be used either by itself or attached to other fabrics or tissues for ornament, or for other purposes to which it may be usefully applied. The mode by which he constructs this fabric is by a sewing machine, having the usual mechanism for forming a seam with any of the form of stitches usually employed in sewing machines, and in addition thereto, and in connection therewith, having certain machinery by which one or more threads, cords, braids, or other similar materials are interwoven with the sewing threads in a variety of ways, so as to form a kind of gimp, or braid, or fringe, by such interweaving, and also to sew the same on to the surface of cloth or other fabric in any desired line or figure by the same operation. One, two, or more of these embroidering threads or cords may be used of any desired size, colour, or material, and interwoven with the sewing threads in many forms. *Patent completed.*

2052. O. F. Morrill. *A certain new and useful apparatus for generating heat for culinary and various other purposes.* Dated July 18, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2053. F. S. Stott. *Improvements applicable to mechanism for warping yarns or threads.* Dated July 18, 1862.

This relates to that class of warping machinery known as warping mills, where hecks are employed, through the eyes of which the threads pass, being afterwards collected together in divisions termed tiers or half tiers, and to mechanism or arrangements for acting upon these divisions of threads when taking the lease, the object of this invention being to prevent the twisting of the tiers when passing on to the mill. The invention consists in modifying the forks which act upon the divisions of the threads when taking the lease, so that such forks will arrange the threads passing through or between their prongs, and cause the threads to be laid upon the mill taperwise, which is accomplished by constructing the forks with an inclined surface formed upon or applied to them at the bottom and between the two prongs of each fork, so that the threads as they pass between the prongs of the forks will come against the said inclined surfaces, and by this means will be placed parallel side by side, and thus the plane in which the threads are arranged will be changed from the horizontal to the vertical position, and in this position pass on to the mill. *Patent abandoned.*

2054. J. R. Abbott. *Improvements in sliding chandeliers, gaseliers, and other pendent lamps.* Dated July 18, 1862.

This consists in providing a means of sliding pendent lamps without taking the centre tube to the bottom of the pendent, so that the patentee can have a central light. This he effects in the following manner:—For making gas pendents upon the water slide principle, the centre tube is required to be only the length that may be necessary for the pendent to be lowered, and he uses four tubes in this case instead of three; the outer tube terminates at its upper end in a gas box or reservoir communicating with the pipes supplying gas to the burners. Inside this tube is fitted the usual hydraulic slide apparatus working through the gas box or reservoir before named, and furnished with its pulleys, chains, and balance-weights, the water cup being above the gas reservoir; inside these slide tubes is fitted the tube leading the gas from the main pipes. The gas passing down this tube rises upwards between the water slide and the outer or fourth tube into the reservoir, and thence down the supply pipes to the burners. In making pendents with the cork slides or stuffing boxes he requires only two tubes. The stuffing box is fixed either within the gas reservoir, or immediately in the top of it, so that it works up and down with the outside tube and the reservoir. For chandeliers and oil or other pendents than those used for gas, the same arrangement as that last described is employed, omitting the cork slide or stuffing box, which is only required for gas. *Patent completed.*

2055. J. S. Jarvis. *Improvements in shirt collars.* Dated July 18, 1862.

This invention is in the cut and make of the band of turn-down collars, whereby creasing or puckering of the outside of the collar is prevented. This invention is not described apart from the drawings. *Patent abandoned.*

2056. R. A. Brooman. *Improvements in generating heat in furnaces and fire places.* (A communication.) Dated July 18, 1862.

This invention consists in bringing superheated steam in contact with coal or other fuel in an incandescent state at any point in the fire above the grate bars. The superheated steam is not mixed with the atmospheric air of the blast or draught below the grate bars before coming in contact with the incandescent carbon. *Patent completed.*

2057. C. A. Day and T. Summers. *Improvements in sheer legs.* Dated July 18, 1862.

This invention consists, 1, in connecting the lower end of the back leg to a screw worm pinion and rack, hydraulic ram, or other like mechanical contrivance, for imparting to and fro motion to the back leg, in order that it may act as a prop to the front legs when they are moved inwards, and as a guy to them when they overhang outwards. The front legs are of the ordinary construction, and work in the usual manner. The invention also consists in the employment of a load at the lower end of the back leg. This loaded leg then acts to some extent as a back balance. *Patent completed.*

2058. A. B. Brown. *Improvements in steam-engines and boilers.* Dated July 19, 1862.

The patentee claims, 1, The construction and form of the expansion valves, as described. 2, The arrangement of the slot link, together with the friction sliding joint and lever, for the purpose of varying the travel of the subsidiary valve, as described. 3, The construction of annular water spaces around the smoke boxes or chambers of horizontal or locomotive boilers, through which the feed water is forced on its passage to the boiler, as described. 4, The construction of the doors of smoke-boxes with water spaces, through which the feed-water is forced on its passage to the boiler, as described. 5, The construction of a tubular hinge as a means of maintaining the calculations of the feed-water between the annular water-space of the smoke-boxes and that of the door, as described. *Patent completed.*

2059. G. J. Yates and J. W. W. Tindall. *A process of deodorizing paraffin, coal, pitch rock, and other like oils and hydro-carbons.* Dated July 19, 1862.

Here the patentee subjects the above-named oils to the action of sulphuric acid, nitric acid, urine, hydrochloric acid, chloride of lime, and fuller's earth. These various substances are added to the oil to be purified at certain definite periods of the operation, and when the oil is at the requisite temperature. *Patent completed.*

2060. R. Barrett. *Improvements in apparatus for working the damper of steam engine furnaces.* Dated July 19, 1262.

This invention is for improvements upon an invention for which letters patent were granted to Phillip Marcus, dated 14th March, 1856, No. 618, and consists in the employment of a double or compound lever, to the long arm of which the rod or attachment to the damper is connected in lieu of the simple lever described in the specification of the said letters patent. The invention further consists in placing the frame in which the bearings for the spindle of the damper are formed at an angle, and in bringing the base of the slot in which the spindle works into a horizontal plane or nearly so. And in order to render the working of the damper as easy as may be, the patentee brings the bearing or edge of the slots on which the spindle works, in the spindle itself, to a knife edge.

2061. R. A. Brooman. *Improvements in revivifying animal black and in apparatus employed therein, and in recovering a product employed in the revivification.* (A communication.) Dated July 19, 1862.

This invention is for improvements upon a former invention for which letters patent were granted to the present patentee, in consequence of a communication from the said Leplay and Cuisinier, the 31st December, 1861, No. 3275. The invention consists in treating animal black as hereafter explained in a series of revivifying cylinders, by preference, four in number. as hereafter stated. Each cylinder contains a perforated false bottom for permitting the inlet of steam from a steam supply pipe; each cylinder communicates with that next to it by a pipe extending from beneath the perforated false bottom of one to the upper part of the next. There is also a pipe leading directly from the upper part of the first cylinder to the lower part of the last in the series. The animal black to be operated on is washed with hot water before being placed in the cylinders; steam is admitted. through the perforated false bottom in the first cylinder, and a solution of caustic soda in a boiling state is admitted at the top of the cylinder; the steam meeting the solution of caustic soda, causes a tribbling and agitating action, and a general motion of all the particles of black; the caustic soda solution being continued to be added, passes into the second, third, and finally into the last cylinder in the series; when the action has been continued long enough in the first cylinder the admission of caustic soda is prevented, and communication closed to the next cylinder. Hot water is now admitted, then hydrochloric acid, after which a solution of biphosphate of lime, then water to wash the black. The black is now completely revivified, is withdrawn, and dried. The like process is continued in all the other cylinders, and finally the caustic soda is made to deposit in the last cylinder in the series. The caustic soda is fully charged with colouring matter from the black, and is drawn off into a separate vessel where it is evaporated. It is next removed in a dry state, and is treated with nitrate of soda under heat, which, driving off the colouring matter, leaves caustic soda. *Patent completed.*

2032. A. Cotille. *Improvements in the manufacture of alcohol.* Dated July 19, 1863.

This invention consists in a process for manufacturing alcohol by means of its component parts, bicarbonated hydrogen (defiant gas) and water. *Patent completed.*

2063. A. Pratt. *Improvements in self-acting firerrms* Dated July 19, 1862.

This consists in improved arrangments in connection with fire-arms, by which the nipple may be capped by the action of the lock when raising the hammer to full cock. *Patent completed.*

2064. W. E. Newton. *Improvements in ordnance and projectiles for the same.* (A communication.) Dated July 19, 1862.

Here the patentee uses, in combination with a hollow core a casing of molten metal whereby he retards the cooling of the exterior of the piece of ordnance to be cast. The same method is adopted in casting round shot. The invention also consists in the use of elongated projectiles of much smaller calibre than that of the gun from which they are to be fired. A sabat and guide band are used to centre the projectile in the gun, the sabat presenting a base to the pressure of the gases of an area equal to the area of the calibre of the gun. To reduce the resistance of the atmosphere to the flight of the projectile the patentee fits to such projectile a point of lead of conical, conoidal, or other such form. *Patent completed.*

2065. W. E. Newton. *Improvements in machinery for preparing fibrous substances for combing.* (A communication.) Dated July 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2066. T. H. Saunders and J. Millbourn. *Improvements in the manufacture of paper.* Dated July 19, 1862.

This relates to an improved mode of drying paper as it comes from the machine, and previous to its being introduced to the sizing vat. The patentees have found that, by the paper being carried along in contact with heated rollers or cylinders, its texture or strength is somewhat improved, and for this reason machine-made paper is always inferior in quality to hand-made, which is what is termed air dried, the sheets being hung up on lines to dry by contact with the air. In order to air dry machine-made paper, instead of drying the paper by bringing it into contact with heated rollers, as heretofore, they cause the paper to pass from the machine over or round a series of skeleton drums or frames, totating or otherwise, and during its passage they submit the paper to currents of air which will carry off the moisture without impairing the solidity or strength of the paper, as is the case when the paper is dried by heated cylinders. This improved mode of drying paper is applicable to engine sized paper, as well as to paper which is sized in the machine at a subsequent stage. *Patent completed.*

2067. W. Tranter. *Improvements in firearms.* Dated July 19, 1862.

This consists, 1, in the use of a stop or holder for the revolving chamber, in the form of a spring lever, with a hooked end adapted to be acted upon by a tooth or projection on the front of the tumbler or hammer, when the latter is raised previous to firing, thereby withdrawing the stop and liberating the chamber, the spring of the lever forcing forward the usual stud, and locking the chamber, when the tooth or projection on the tumbler or the hammer has passed out of the hooked end of the lever. 2, In the use of a bridle or cover for the works of a revolver, which may be removed with facility, so as to admit of the works being examined as required. 3, In the use of a centre rod for the chamber to revolve on, with a spring or spring lever acting in a slot or cavity in the rod, which spring, on being compressed into the cavity, allows the rod to be withdrawn from the body, in order to take out the chamber when required. There is also a slot or cavity in the frame, into which the spring of the rod passes, whereby the rod is held firmly in its position. 4, In adapting and applying to ramrods a lubricating brush, or elastic fabric, or substance, capable of holding lubricating material for lubricating the inside of the rifled barrel each time it is boarded. 5, In forming the grooves of rifle barrels in the shape of a hyperbolic curve, for the purpose of getting rid of angles in the cross sections so as admit of the lubricating rod cleaning the barrel or softening the deposit therein with facility. *Patent completed.*

2068. C. Ramsay. *An improved military cloak.* Dated July 21, 1862.

This consists in making a cloak in the following manner, that is to say:—The body of the cloak is cut nearly circular, and has a hood affixed to the neck part thereof; a loose cape is also intended to be connected when desired to the neck part of the cloak by buttons and button holes; sleeves are also sewn to the cloak to receive the arms of the wearer. A cloak thus formed makes an excellent tent either for soldiers or civilians. *Patent abandoned.*

2069. J. W. Green. *Improved method of cutting sheet and plate glass to any given design, giving the finished form the brightest polish possible.* A communication.) Dated July 21, 1862.

This consists in subjecting the sheet plates and other glass to a graduated heat in an oven (muffle oven) especially constructed. The glass is kept in this oven until it becomes softened; then it is placed into a draught oven (zug oven) where a great heat is obtained by a bellows; the glass is then put between a lever, which is so constructed as to cut the rough edges clearly off, leaving the article so pressed of the finest polish and finish. The dies are so arranged as to cut and press the glass when of various constructed thicknesses. When the glass is cut and pressed, it must be gradually cooled. Glass manipulated on this principle shows a higher degree of polish than by other methods. *Patent abandoned.*

2070. E. Bazin. *An electric railway carriage signal.* Dated July 21, 1862.

The main feature of this invention consists in galvanizing or coating the coupling chains with zinc, whereby electric communication is produced throughout a train for the purpose of striking an alarm bell or sounding plate placed near the engine-driver. *Patent completed.*

2071. W. E. Gedge. *Improved excavating or boring apparatus.* (A communication). Dated July 21, 1862.

This consists in making a hole by ordinary means in any body of material, and introducing therein an instrument which, by its action, will form an inner cavity of larger diameter than that of the primitive. The invention is especially applicable to blasting. *Patent completed.*

2072. T. Davey. *Improvements in the manufacture of gunpowder and explosive compounds.* Dated July 21, 1862.

The patentee claims, 1, the mixture with ordinary gunpowder materials in the course of manufacture of starch, dextrine, gum, flour, or sugar, prepared as described with nitric acid, or nitric and sulpheric acids combined. 2. The manufacture of gunpowder, or other explosive compounds, into tubes, or hollow pieces, or grains. 3. The use of paraffin, turpentine, naptha, or other suitable hydrocarbon in the manufacture of gunpowder and explosive compounds. *Patent completed.*

2073. A. M. Fell. *Improvements in obtaining or manufacturing sulphate of ammonia and manure.* Dated July 21, 1862.

This consists in using matters arising in the distillation of oil from bituminous schales or schists. When the bituminous matter is distilled, there comes over from the retorts along with the oil a large proportion of ammoniacal liquor of water, which, after separation from the oil, is put into a vessel and has sulphuric acid added to it until it is ascertained by the ordinary tests that all the ammonia has combined with the sulphur. The resulting liquid is then put into a suitable pan and evaporated to dryness, the dry residuum being sulphate of ammonia. The manure is obtained by mixing the sulphate of ammonia with the matters remaining in the retort when the distillation is completed. *Patent abandoned.*

2074. A. Naudain, J. Peacock, and W. H. Walton. *Weaving, being an improvement in looms for weaving all kinds of textile fabrics.* Dated July 21, 1862.

This consists in weaving fabrics in a circle, or any part of a circle, and in using a plurality of shuttle passing through a warp or web at the same time, and in carrying the shuttle or shuttles through the warp by means of friction rollers, pulleys, or belt, or their equivalents, and by heating up the weft or filling in sections. *Patent abandoned.*

2075. W. Clark. *An improved pomade or balsam termed "Balsam Achille."* (A communication). Dated July 21, 1862.

This balsam or pomade is made of resin and galipot, white fat, and suet, virgin and yellow wax, fine olive oil, camphor, white soap, benzoin, spirits of wine, and essence of lavender. The above matters are mixed together, the solids being dissolved in the liquids so as to form a homogeneous composition. This odoriferous cosmetic is first melted and then applied by friction. *Patent completed.*

2076. A. Phillips. *Improvements in looms for weaving figured fabrics.* Dated July 21, 1862.

This refers to a previous patent, dated 18th July, 1859, (No. 1694). In this invention the looped or velvet pile surface of the fabric is formed wholly of the weft, which is bound in by a secondary or binding weft. The present invention comprehends an improved arrangement of the weaving mechanism, so as to accomplish a similar result with simpler but more efficient means. *Patent abandoned.*

2077. T. Meriton. *Improvements in steam-engine governors and speed regulators for machinery.* Dated July 22, 1862.

This relates to the fly wheel governor, and the invention consists partly in simplifying this form of governor, by dispensing with superflous parts, thereby effecting economy in first cost, but mainly in rendering more certain, prompt, and efficient its action by improved construction, arrangement, and disposition of parts. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Oct. 18, 1862.

2816. W. E. Gedge, 11, Wellington-street, Strand. An improved apparatus for extracting condensed steam. (A communication.)

Dated Nov. 27, 1862.

3182. J. L. Linton, Buckingham Palace Hotel, Buckingham-gate. Improvements in the means of generating steam, and in the apparatus to be employed therein. (A communication.)

Dated Jan. 9, 1863.

76. E. A. Goupil, 10, Rue d'Hauteville, Paris, gentleman. An improved locomotive apparatus.

Dated Jan. 13, 1863.

102. T. Boyle. Gray's Inn-terrace, glass silverer. A new apparatus for multiplying indefinitely the reflections of all objects that are capable of being viewed in it.

Dated Jan. 15, 1863.

131. T. C. Barraclough, Manchester, engineer. An improved alarum apparatus, which may be employed in connection with locks or other fastenings. (A communication.)

132. J. Harrop, Manchester, analytical chemist. Improvements in the treatment of organic fecal and urinous matters for the purpose of deodorizing the same, and in the preparation of a portable manure therefrom, and in the treatment of ashes, or other refuse of combustion, to be combined therewith, also for improvements in machinery be employed in the manufacture of the said manure.

134. R. Ferrier, gas engineer, Edinburgh. Improvements in wet gas meters.

Dated Jan. 16, 1863.

144. J. Kerr, Manchester, painter. Certain improvements in the means of retarding or stopping railway and other carriages.

Dated Jan. 17, 1863.

150. J. Edwards, 29, Basinghall-street. Improvements in the manufacture of buttons.

156. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the manufacture of buttons. (A communication.)

Dated Jan. 19, 1863.

158. C. Norton, 47, Hawley-road. A new or improved method of roughing horses.

164. J. J. Lundy, Leith, colour manufacturer. Improvements in the manufacture of metallic casks and vessels.

Dated Jan. 22, 1863.

198. J. M. Binger, Brussels, gentleman. An improved paste, or composition, to cover the rollers used by letter-press printers.

Dated Jan. 23, 1863.

206. J. Milner, 7, Bridge-street, Westminster. Improvements in steam engines.

208. E. Strangman, Waterford, Ireland. Improvements in pipes for smoking tobacco.

212. P. A. Cole, Croydon-street, civil engineer. Improvements in the articles of dress known as collars, cuffs, wristbands, shirt-fronts, habit-shirts, and petticoats.

214. E. T. Hughes, 123, Chancery-lane. Improvements in breech-loading firearms. (A communication.)

Dated Jan. 24, 1863.

216. W. Mellor, Ardwick, and W. Whaley, Rainow, Chester, tool makers. Improvements in steam hammers and other engines driven by steam.

220. M. A. F. Mennons, Rue de Dunkerque, Paris. Improvements in machinery for punching and cutting metals. (A communication.)

222. A. J. Sax, Paris, musical instrument maker. Improvements in rendering drum-skins and gut-strings less liable to hygrometric influences.

224. F. Tolhausen, Rue de Faubourg, Montmartre, Paris. Improvements in looms for weaving ribbons. (A communication.)

Dated Jan. 27, 1863.

236. C. Askew, Charles-street, Hampstead-road, engineer. An improved railway chair and joint for rails on railways.

238. R. A. W. Green, Putney, boat builder. Improvements in light rowing boats, usually termed wager boats.

242. W. C. Wilkins, Long-acre, lighthouse engineer. Improvements in lamps.

Dated Jan. 28, 1863.

244. H. Watson, Renton, brick builder. Improvements in the heating arrangements of stoves for drying woven fabrics.

246. W. E. Gedge, 11, Wellington-street, Strand. Improved machinery or apparatus for fastening, by screws, boots, shoes, and other articles composed of leather. (A communication.)

248. J. Oglesby, J. Dickinson, W. M. Dickinson, and J. Dickinson, York. Improvements in apparatus for steaming, cooking, and generating gas.

250. C. Mace, Sunderland, practical engineer. Improvements in steam engines for propelling engines, and for other purposes.

252. F. W. Wymer, engineer, 7, St. Ann's-row, Newcastle-on-Tyne. Improvements in steam engines.

254. W. Conisbee, 39 and 40, Herbert's-buildings, Waterloo-road. Improvements in cylindrical chromo-lithographic printing machines.

256. W. Clark, 53, Chancery-lane, engineer. Improvements in the means and apparatus for copying and reproducing sculpture and other objects of art. (A communication.)

258. C. P. Stewart and J. Robinson, Atlas Works, Manchester, engineers. Improvements in and applicable to that apparatus known as Giffard's injector, and in the adaptation of it to locomotive and other boilers.

260. H. Crichley, Birmingham, ironfounder. Improvements in reaping and mowing machines. (A communication.)

Dated Jan. 29, 1863.

266. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the manufacture of candles. (A communication.)

268. W. Ball and J. Wilkins, Nottingham. Improvements in machinery employed in the manufacture of looped fabrics.

270. N. Clayton and J. Shuttleworth, Stamp End Works Lincoln. Improvements in thrashing machines.

272. A. Pritchard, Derby, black lead manufacturer. An improved method of preserving the contents of packages from air, water, or damp.

274. W. Clark, 53, Chancery-lane, engineer. Improvements in the condensation of steam, and in apparatus for the same. (A communication.)

INVENTIONS PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF COMPLETE SPECIFICATIONS.

Dated Jan. 9, 1863.

262. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. Improvements in the construction of granaries. (A communication.)

265. J. Mackenzie, Arundel-square, Islington, engineer. Improvements in shaping machines for curvilinear surfaces.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, Feb. 10, 1863.

2640. W. B. Lord and F. H. Gilbart. Loading firearms, and in blasting.

2654. A. Prince. Manufacture of varnish, printing-ink, paint, and printing colours. (A communication.)

2664. W. C. Wilkins. Gas burners.

2671. R. Broadbent. Gas regulators.

2675. A. Dalrymple. Processes of depositing metals by galvanic action.

2680. A. Barclay. Printing textile materials and fabrics.

2681. W. E. Gedge. Improved means or apparatus, by the use of which pieced or perforated cocoons may be spun. (A communication.)

2683. J. E. Billups. Fixed points for railways.

2686. F. Watkins. Milking cows.

2687. F. E. Blatspiel. Diving apparatus. (A communication.)

2688. W. Clark. Preserving goods from fire. (A communication.)

2690. F. Johnson. Fire-escapes.

2696. S. Holland. Manufacture of bricks.

2699. T. Beards. Cultivating land.

2700. S. F. Cox. Washing and tanning hides and skins.

2713. A. V. Newton. Condensers or coolers. (A communication.)

2726. J. H. Johnson. Manufacture of paints or pigments. (A communication.)

2746. J. Durrant. Form and construction of chimney tops.

2749. A. V. Newton. Sewing machines. (A communication.)

2750. S. Chatwood. Fire and thief-proof depositories.

2753. G. Haseltine. Jacks and screw nuts. (A communication.)

2757. W. G. Haig. Apparel.

2758. J. Gumbley. Break for vehicles.

2784. J. B. G. M. F. Piret. Lubricating apparatus.

2815. J. Fuller. Treating india-rubber used on a wire or wires for insulating the same.

2821. J. Clark. Applying railway brakes.

2842. J. Spencer. Non-conducting compositions.

2903. E. S. Tudor. Purification of lead.

2906. T. Sutton. Preparing albumenized paper for photographic purposes.

3102. J. Oxley. Separating liquids from substances.

3164. G. Ranson. Preparing clay for brickmaking and other purposes.

3264. T. E. Blackwell. Barometers.

3284. J. Sellars. Manufacture of pulp.

3338. E. Thorold. Drill braces.

3418. M. Clark. Treating waste liquors.

3443. E. Stevens. Preparing dough and paste.

3483. F. Applegate. Manufacture of a kind of woollen cloth.

16. A. Bamford, R. Blomley, R. Taylor, and J. Lett. Looms for weaving.

73. W. H. Tucker. Locks.

93. E. D. Chattaway. Railway signals.

131. T. C. Barraclough. Alarum apparatus. (A communication.)

133. G. Graham and J. McLeod. Turkey-red dyeing.

144. J. Kerr. Retarding or stopping carriages.

208. E. Strangman. Pipes for smoking tobacco.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Feb. 6, 1863.

2231. Sir J. S. Lillie.
2233. A. J. Moreau and A. E. Ragon.
2234. A. J. Moreau and A. E. Ragon.
2235. T. De la Rue.
2244. J. Lancelot.
2246. W. E. Gedge.
2249. A. J. Martin, J. Goss, and J. Bush.
2257. A. Delrue.
2258. C. M. Westmacott.
2261. A. B. Childs.
2269. J. R. Tussaud and F. C. Tussaud.
2292. J. Hearn.
2313. F. Barnett.
2375. W. H. Turner.
2531. J. Pender.
2957. G. Haseltine.

Sealed Feb. 10, 1863.

2262. C. Sengry.
2263. G. Sanders.
2271. W. L. Boyle.
2273. H. Twelvetrees.
2280. A. Walker.
2281. J. Irvine and J. W. Hand.
2285. W. Beatson.
2287. D. P. Marques.
2290. W. J. Curtis.
2296. W. B. Herapath.
2297. C. E. Spagnoletti.
2301. T. Cawin.
2302. T. F. Kirby.
2305. J. H. Johnson.
2307. H. Garside.
2314. J. Cimeg.
2405. E. A. Pontifex.
2410. J. H. Johnson.
2423. J. H. Johnson.
2465. J. H. Johnson.
3115. J. Jewsbury.
3311. M. Osborne.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

276. A. and E. M. Denny.
279. L. P. Barré.
286. R. and T. Fielden.
288. R. Bodmer.
324. A. L. E. Breittmayer.
335. J. H. Johnson.
345. J. Langford and C. Chester.
377. A. V. Newton.
803. G. F. Wilson.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending February 13, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
1905	0	10	1914	0	4	1923	0	8	1932	0	4	1940	0	10	1948	2	6
1906	0	10	1915	0	8	1924	0	4	1933	0	8	1941	0	4	1949	0	4
1907	0	4	1916	0	4	1925	0	4	1934	1	4	1942	0	10	1950	0	6
1908	0	4	1917	0	8	1926	0	4	1935	0	10	1943	0	8	1951	0	10
1909	0	4	1918	0	10	1927	0	4	1936	0	8	1944	0	4	1952	3	6
1910	0	4	1919	0	4	1928	0	4	1937	0	4	1945	1	2	1953	0	4
1911	0	8	1920	0	10	1929	0	6	1938	1	6	1946	0	10	1954	2	10
1912	0	10	1921	0	4	1930	1	0	1939	0	4	1947	0	4	1955	0	10
1913	0	4	1922	1	4	1931	0	6									

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback, 1s.

	£	s.	£	s.
Teak ....load	14	0	15	0
Quebec, red pine	3	10	4	10
,, yellow pine	3	0	4	0
St. John, N.B., yellow	5	0	5	10
Quebec oak, white	5	10	6	10
,, birch	3	0	3	10
,, elm	3	10	5	0
Dantzic, oak	3	10	6	10
,, fir	2	10	3	10
Memel, fir	3	0	3	5
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzig, fm.	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	19	10
St. John, white spruce	14	10	16	10
Yellow pine, per reduced C.				
Canada, 1st quality	17	0	18	0
,, 2nd do	11	0	12	0
Archangel, yellow	13	0	13	10
St. Petersburg, yellow	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white	9	0	9	10
Gefle, yellow	10	0	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.				
,, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
PUMICE STONE, per ton	5	10	9	0

OILS, &c.

	£	s.	£	s.
Seal, pale ....per tun	48	0	0	0
Sperm body	85	0	86	0
Cod	48	0	0	0
Whale, South Sea, pale	44	0	44	10
Olive, Gallipoli	60	0	0	0
Cocoanut, Cochin	56	10	57	0
Palm, fine	39	10	41	0
Linseed	45	0	0	0
Rapeseed, English pale	55	0	0	0
Cottonseed	34	0	45	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
IRON:									
Welsh Bars, in London	per ton	6	10	0	to	7	0	0	2½
Nail Rods	,,	7	5	0	,,	7	10	0	,,
Hoops	,,	8	10	0	,,	9	0	0	,,
Sheets, single	,,	9	10	0	,,	9	15	0	,,
Staffordshire Bars	,,	7	15	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	17	6	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	14	6	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
STEEL:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	10	0	,,	18	0	0	,,
COPPER:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8½	,,	0	0	0	3to7½
Fine Foreign	per ton	0	0	0	,,	0	0	0	3
TIN:									
English Block	pr cwt.	5	15	0	,,	0	0	0	2½
Bar	,,	5	16	0	,,	0	0	0	,,
Refined	,,	6	0	0	,,	0	0	0	,,
Banca	,,	5	1	0	,,	0	0	0	nett
Straits	,,	6	0	0	,,	6	1	0	,,
TIN PLATES:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
LEAD:									
Pig, English	per ton	21	5	0	,,	21	10	0	2½
Spanish, Soft	,,	20	10	0	,,	0	0	0	,,
Shot, Patent	,,	23	15	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	0	0	0	,,
SPELTER:									
On the spot	,,	18	7	6	,,	0	0	0	nett
ZINC:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
QUICKSILVER	pr btl.	7	0	0	,,	0	0	0	3
REGULUS OF ANTIMONY:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
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THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, FEBRUARY 20, 1863.

SIR WILLIAM ARMSTRONG.

Sir William Armstrong has just resigned a post he should never have occupied; and it will, perhaps, for some time remain an unsolved problem why he occupied the post so long. Being a man of great firmness and tenacity of purpose, he held on till the last, and it was only when he saw the rising wave threatening to engulf him, that he surrendered. His position has for some time past been as untenable as his much vaunted gun has been imperfect. We have so frequently criticized his gun that it is needless to do so now; and we have several times pointed out the unreasonableness and injustice of a man being a public servant, and, at the same time, a sleeping partner in a large manufactory, where tens of thousands of pounds of the public money were being annually expended. Sir William being an inventor of rifled artillery, and being, as a matter of course, prejudiced in favour of his own invention, did his best to keep other artillerists in the back ground, and, as an equal matter of course, used all his official influence to send grist to the Elswick mill. His position was so anomalous—we may say preposterous—that it is unaccountable that the British public permitted itself to be trifled with so long in the matter. And, perhaps, the most remarkable thing of all has been that Armstrong guns have been made at least a third part cheaper at Woolwich than at Elswick. Government establishments are famed for their wastefulness and extravagance, and private firms have been extolled for economical production. But in this Armstrong gun business we have not only seen the inventor made the official, but the official permitted to have an interest in an establishment where his own gun was made at a much greater cost to the nation than if it had been made under the superintendence of Mr. Anderson, at Woolwich. Knowing these facts, we have not hesitated to say that the whole affair has been the most gigantic job of the nineteenth century, and future historians will refer to it as an instance of the immorality of our official life, and the stupidity of the public. People will wonder how Sir Wm. Armstrong attained his position and maintained it so long.

We will give one or two reasons. The Armstrong gun was brought before the public just after the Crimean war, when it was supposed by many people, in this and other countries, that our military strength had suffered something like a collapse. Something was wanted to re-establish confidence; and it was found in the estimation of some in the Armstrong gun. The virtues of the gun were blazoned by the press. England, it was stated, had found a weapon that would make her all-powerful on land and sea. Sir William being an able diplomatist—in fact one of the ablest diplomatists living—took advantage of the opportunity. He managed to get the *Times* and other public organs on his side. He whispered in the ear of Sir Benjamin Hawes, then Under Secretary of War, and secured his support. Sir Benjamin married a sister of the younger Brunel. By a nice little diplomatic arrangement, we find Brunel's son made a *partner* in the Elswick firm. And so the influence of Sir Benjamin was obtained and secured, partly, no doubt, through his social affections. A master bit of policy this! We believe we are right in stating that Sir Benjamin was trustee of the late Mr. Rendel, C.E., whose son was made another partner of the Elswick firm. Sir William having the ear of the Government through Sir Benjamin Hawes, and possessing the power to inspire the press, became master of the situation. Million after million of the public money was voted, year after year, for the Armstrong ordnance. Elswick was in full feather. England was becoming possessed of a matchless weapon that would defy the world in arms. During this period of prosperity and triumph one small voice endeavoured to make itself heard above the bustle and din of military preparation. The Mechanics' Magazine analysed the gun and the projectiles made for it, and stated that they could not possibly remain long in her Majesty's service. The same small voice that spoke of the inherent deficiencies of the weapon, questioned the peculiar position occupied by its inventor, and condemned the extravagant price paid for the new system of artillery. Occasionally, Sir William would appear in the columns of the *Times*, denying our allegations, and vindicated his system with polished rhetoric. But neither his diplomatic tact, his eloquence, his industry, nor his tenacity, could avail against the truth. His resignation, whatever may be said to the contrary, is a virtual abdication of power, and the Armstrong gun, which has been so vastly praised by so many tongues and pens, will figure only insignificantly in our artillery annals. Perhaps many, who at first doubted our sincerity or our science, will, in future, give us credit for possessing a little of both.

HARBOURS OF REFUGE.

The reply of the Duke of Somerset last week to Lord Ravensworth's inquiry whether any steps were in progress to carry out the recommendations of the Royal Commission, with respect to the formation of harbours of refuge, re-opens the whole question, and undoes all that has been done during the last ten years. We are brought back to the point we started from, and doubts are intimated that harbours of refuge are not necessary or even desirable for the preserving of life from shipwreck on our coasts. This is really most disheartening. It seems as if no public question can be solved openly and on its own merits, but must be determined by personal considerations, and that the saving of money is to be preferred to the saving of life.

The First Lord of the Admiralty stated the case very fairly, and pointed out how the local authorities are all willing to have harbours constructed, on condition that they are not to be called upon to contribute a fraction towards the cost. But we think he was in error in some of his conclusions. He expressed his belief that it would be a great mistake to make a great many harbours along the coast, as the commissioners recommended; and that no such a saving of life and property, as some people anticipated, would be effected by them; for all the evidence taken on the subject showed that, on the contrary, they would lead to persons continuing to employ very unseaworthy and badly found ships. In the first place, we do not perceive how the number of harbours, which the commissioners recommended should be formed, can be called a "great many," seeing that the total was no more than ten—namely, two on the north-east coast of Scotland, and three on the north-east coast of England; one at the Isle of Man, two on the Irish coast, and two in the Bristol Channel, or rather on the north Cornish coast; but of these ten four—Wick, Peterhead, Waterford, and Tyne river—are trading harbours. When we consider the length of coast, on which no shelter is to be found, ten harbours cannot be termed a great many, and still less so if we cast our eyes on the wreck chart, and note how many ships have been lost between the sites where it is proposed to erect them and existing harbours. Their cost, estimated at four millions, is a far more formidable objection, though the commissioners proposed the public grant should be limited to £2,365,000, and the remainder, £1,625,000, to be raised in the localities. Mr. Wilson's Select Committee proposed fewer harbours, at half the cost, but among them were two which the subsequent Royal Commission rejected, viz., at the Mumbles, and at the Skerries, so that the number would be reduced to one-half, and the cost to £1,600,000. Among these were harbours at the points where they are most needed.

The part of the Duke of Somerset's reply, which stated that harbours of refuge would not preserve so many lives and so much property from shipwreck as was anticipated, if taken in connection with what was said by Mr. Milner Gibson in the House of Commons last session, and with what Lord Ravensworth stated about the apathy of shipowners, and their fear that harbours would induce crews to loiter on insufficient grounds, leads to the inference that Government are not so convinced of the usefulness of these works of shelter as it was imagined they were. They appear to attach more importance to the individual opinions of certain shipowners than is warranted by the general tenor of evidence taken before the Select Committee and Royal Commission. Mr. Allan Gilmour, of Glasgow, one of the largest shipowners in the country, was of opinion that harbours of refuge, marked down as such, are the means of causing loss of life and property rather than of saving them, by inducing captains to run down to them instead of keeping the open sea. Accordingly his captains were instructed, in case of accident, to return to the port of departure, and by all means to keep the sea—not run for a harbour of refuge. The result of this policy has been, that out of his numerous ships, which, during twenty years, made upwards of 1,700 voyages to all parts of the world, he lost ten only, and not one of them on the British coasts. This fact speaks rather in favour of the admirable organization and careful supervision of Mr. Gilmour's service than of the inutility of harbours of refuge. At all events, he did not find many men in his town to support his views. True, Mr. Allan, owning a fine fleet of sailers and steamers, and who had been eighteen years at sea in all grades, from apprentice to master, thought harbours useless, except on the east coast of Scotland, and for one there he would not object to contribute his quota of taxation, if the work were judiciously and properly done. So that after all his opinion amounts to this, that harbours of refuge are useless where they are not wanted—a very logical conclusion, from which he will find few to dissent. The rest of the witnesses were strongly in favour of creating places of shelter, but more especially seafaring men. At Dundee, one witness believed that harbours would not save lives, though he had admitted having occasionally resorted to them under stress of weather, consequently, his experience negatived his belief. Of the hundreds of witnesses who have been examined during the years the question was being investigated, these were the only three that expressed doubts of the utility of harbours of refuge, and of their conducing to the preservation of life and property from shipwreck. The evidence on the other side was overwhelming—from seamen, shipowners, fishermen, naval officers, merchants, and, indeed, all that are in any way connected with the sea. The Liverpool Mercantile Marine Association, composed of 800 members, sent their secretary before the commission to say that they considered it "not merely a shipowners' question, but a question affecting the lives of masters, officers, and seamen." Mr. Langton, as the representative of the Liverpool underwriters, declared that they considered the establishment of harbours of refuge would be advantageous to the protection of their interests, and likewise for the protection of life and property. The Hull Chamber of Commerce presented a memorial, setting forth that the members considered the question one of great importance, and the South Shields' seamen petitioned for the establishment of a harbour on the north-east coast. It would be easy to multiply evidence of the same description; but we have preferred to take that which was afforded by large representative bodies, who cannot be accused of having any local interest, and who advocate the establishment of harbours of refuge on their intrinsic merits, and because of the public good they will effect. The reader will probably be satisfied, from what has already been said, that the preponderating weight of testimony is against Mr. Gilmour's proposition, which Government seems disposed to entertain, and we confess to be unable to discover upon what grounds they can justify the reopening of the question.

The Duke of Somerset alluded to the harbours in the course of construction, and expressed an unwillingness that Parliament should incur fresh expenditure until they were finished. But it is an error to speak of these works as harbours of refuge, with the exception of Holyhead and Portland, for they are quite useless as places of shelter, and were expressly designed for military purposes. No ship would go into Dover; but into the Downs in case of stress of weather. The works of Harwich were confined to deepening the Channel that it might serve as a port of call should war ever occur in the North Sea. Alderney and Jersey are both out of the track of ships going up or down Channel. Even Portland is being transformed into a fortified naval station to rival and neutralise Cherbourg; and Holyhead was undertaken for the convenience of the Irish mail, so that in reality we have not a single *bona fide* harbour of refuge; for a shelter of this kind, being for the benefit of all nations, should be exempt from attack in war as lighthouses are, and consequently be left undefended.

The imputation cast by the Duke of Somerset upon certain persons in the coal trade—that send old ships to sea which are fit for nothing—is most discreditable to them. If anything, Lord Ravensworth's apology makes it worse. He says that, stripped of every rag of protection, they are compelled to compete on their own shore with foreign ships, navigated, equipped, and built cheaper than English colliers, and, therefore, that it ought not to excite surprise if the owners of the latter, in order to be able to carry on competition, send ships to sea badly found and not fully manned. Never was a lamer or more infamous excuse proffered, and that any English gentleman could have been found to utter it, is a marvel of the times, only to be equalled by the fact that not one among the peers who had heard this barbarous, un-English, and un-Christian doctrine, had the courage to protest against it. Were the same thing done ashore by an employer of labour, he would be tried for manslaughter, perhaps for his life. If a railway company were to plead such an excuse, Lord Camphell's Act would teach them what it cost in purse to neglect proper precautions, and to risk life to be able to carry on competition. The Duke said harbours of refuge would induce coal shipowners to persevere in this system. It is impossible to discover the train of reasoning by which he arrives at this conclusion, or to find, in the half-dozen volumes of Parliamentary reports on the subject, any trace of evidence to that effect. We are told of ships being sent to sea with timbers rotten, and sails so worn as to be blown from the yards in the first gale of wind; and of other vessels so bad that no crew could be found to ship in them; but not a word that the provision of places of shelter would make matters worse.

From the whole tenor of the First Lord's speech, it is to be gathered that Government have determined to defer commencing the construction of harbours of refuge, and to wait to see how Mr. Milner Gibson's Act of last session operates, to the improvement of trading harbours, by means of advances from the Public Loan Commissioners, for carrying out works under local direction. The scheme is certainly an admirable one, and appears, up to the present time, to have been successful.

THE ATLANTIC CABLE.

TO THE EDITOR OF THE MECHANICS' MAGAZINE.

SIR,—The fact of two papers having been read before the Society of Arts, followed by important discussions, joined in by some of the most eminent men connected with telegraphy, together with the proposition of Sir Edward Belcher, that the society should appoint a committee for the further consideration thereof, in order to elucidate all possible information to the end that satisfactory data may be afforded which shall place the construction, submergence, and successful working of all future submarine cables beyond the possibility of failure, is significant of the importance the second proposed Atlantic cable holds in public estimation.

This is as it should be; too much light cannot possibly be thrown on a matter of such importance, affecting as it does the interests, and probably the destinies of the Old and New Worlds—presuming that the scientific consulting committee of the Atlantic Telegraph Company are not too wise in their own conceit to profit by and adopt conclusions which are incontestably established beyond the power of refutation, as well as others which are in a fair way of receiving a solution. We are justified in entertaining a little trepidation on this point—in assuming that prejudice, foregone conclusions, and other causes which shall be nameless, because they suggest themselves, will retain their obstructive shapes; therefore we cannot be over sanguine that the beneficial results of "more light" will receive that appreciation at the hands of the gentlemen in question which they ought to receive. The past justifies it, present operations confirm it, and the future is not devoid of cause for misgivings.

The failure of the Atlantic cable resulted in the appointment of a commission by Government to sift the whole matter of ocean telegraphy in every sense of the word;—the best mode of constructing a cable so as to meet the highest scientific requirements, as well as the best route, mode of submersion, and, indeed, everything that in the remotest degree appertained to the subject. The result was a blue book of more than ordinary dimensions, to which universal testimony has been borne as to its comprehensiveness, the soundness of its conclusions, and the incalculable service it has rendered to the general subject of telegraphy; and further, that it completely and satisfactorily solved the problem of the feasibility of long lines of deep sea cables. The propositions therein laid down may be considered the electric and telegraphic articles of faith of this committee and of all advanced telegraphists; not, indeed, the ultimate good, the *ne plus ultra*, but certainly a far advanced stage from which it were little short of criminal to recede, and which, if acted upon, would infallibly ensure success.

During the two years over which this committee extended its sittings, thousands of experiments were made, and almost every individual at all acquainted with the subject—manufacturers, electricians, telegraph engineers, patentees of insulating substances, instrument makers, theorizers, and practical men — were examined before it, and their separate evidences are to be found in its pages. Truly, the Government, and the committee also, were thoroughly imbued with a sense of the importance and stupendousness of the matter they thus took in hand; hence the length of its sittings, and also its completeness and comprehensiveness. Probably no Government committee of modern times ever had so important an inquiry entrusted to them, nor one so difficult of comprehension, nor from the mass of conflicting evidence, opposing theories, and petty interests of the examiners—one in which the tasks of arriving at sound, independent, and logical conclusions, was attended with so much anxious labour and deliberation; so much more is it to their honour, therefore, that without leaning to this or that theory, or the favouring of this or that interest, they steered clear of all, and arrived at the only conclusions to which honest and impartial men could come. They have their reward in that their labour has been appreciated by the foremost men of the age, both in England and on the continent; nor does the country begrudge the expense of this commission, which, of course, was something considerable. Yet, notwithstanding all this, one is almost tempted to exclaim that this committee might almost as well not have been appointed, seeing that its most important conclusions have been ignored by those who should have set a practical example of appreciation thereof to all the world. I refer to the promoters of the Persian Gulf cable, which, notwithstanding the assertion of the *Times*, that in its design the "recent improvements in the science of telegraphy have been taken advantage of," and notwithstanding official oracles claim for it a prospective superiority of 25 per cent. over all others, by virtue, we are led to suppose, that the Government has not "given over this great national work, to any company, contractor, or concessionaire;" the glaring fact stands out unmistakeably that this cable, in all the details of its structure, from the most important down to the most trifling, is an absolute departure from every recommendation made by the Government committee, and is as far removed from what a submarine cable (especially for the tropics) ought to be as the North is from the South. The advantages which its sectional solid conductor is said to possess over a solid one only, are purely gratuitous, and founded only on supposition, while its disadvantages, as compared with the latter, and its immeasurable inferiority to a stranded conductor, will be apparent to every one who gives the matter a little careful consideration. Its insulation of alternate layers of gutta-percha and Chatterton's compound is the worst that could have been devised; the latter is said to contain resin; and therefore has a most pernicious influence on the former; add to which the inefficiency of gutta-percha as an insulator, and its notorious inadaptibility for warm climates; and this course has been taken by Government itself after its committee had indorsed the dictum of the superiority of caoutchouc! Lastly, its outer sheathing is also entirely at variance with the teaching of the blue book; for that which is to guard from danger the precious charge within is itself the source from whence peril emanates to the core; protection by such means is well nigh an exploded fallacy; the core is better free from the embrace of so dangerous a neighbour, and can better take care of itself.

With such an instance of suicidal departure from the teachings of experience, and such a wholesale setting at nought by the India Board of the results of the grave deliberations of the Government committee, we turn our attention prospectively with but little confidence to the intentions of the Atlantic Telegraph Company. True, we have the authority of the Right Hon. Stuart Wortley, that the scientific committee appointed will ensure a cable which shall combine the results of the most advanced scientific acquirements, practical skill, and every other knowledge appertaining to the manufacture and submergence of a cable. And we have also his reiterated assurance that the company is free and unshackled to choose whatsoever cable they will; and it would ill become us to call into question his veracity; nevertheless, we have a right; and it is our duty to ascertain how far these statements are likely to be borne out by facts; and in order to do this, we will take the case of the company on its own grounds, and will not attempt to call into question whether theirs is or is not the best route that could have been selected. And further, we wish it to be understood, that our notions of a good cable are the results of actual experiment, coinciding with the opinions of that committee of which the chairman of the Atlantic Telegraph Company was so distinguished a member. The unusual prominence given to submarine telegraphy of late, is evidently mainly due to the exertions of this company to carry out their undertaking; and, doubtless, we all rejoice in the confident hope that they will be able to do so. The paper read before the Society of Arts, by Mr. Masey, unquestionably received its inspiration from Old Broad-street, and, therefore, to a certain extent, we may consider that it embodied the ideas of the Atlantic Company. As to the character of the cable that would probably be fixed upon, and also as to the general intentions of the company, this, therefore, with certain remarks made by other gentlemen similarly connected, in the two nights discussion which ensued upon that paper, will afford good grounds for the following remarks; also in connection therewith let us not forget the statement made by Mr. Stuart Wortley, at Liverpool, a short time since, that the "manufacture of the new cable would be submitted to the widest competition." It is a remarkable fact, that in all this lengthened and important debate, the comparative merits of gutta-percha and india-rubber were never discussed; every other imaginable topic connected therewith, from marine animalculæ, who were specially created to prey upon submarine cables, to the influence of the *aurora borealis,* all things relevant and irrelevant, received due share of attention, and more. But this, *the* most important point of all, was all but utterly ignored. Mr. Masey disposed of the whole matter in one short paragraph, unwittingly including therein the quintessence of the Government committee's deliberations on insulation, and therefore upsetting entirely the conclusion to which he most unaccountably arrived, thus betraying either a total ignorance of the nature of india-rubber, or prejudice, or both combined. We are told in the same breath that it is not durable, and that we are not possessed of sufficient data to warrant its use (!) both of which statements have been satisfactorily refuted over and over again; and therefore it is the more astonishing that any man should commit himself to allegations which the history of caoutchouc, long before gutta-percha was discovered, proves both fallacious and absurd. Without disparaging gutta-percha, we may fearlessly assert, that there is no substance derived from the vegetable kingdom that is more durable and indestructible than india-rubber.

Mr. C. F. Varley negatively acknowledges its superiority, but thinks we have arrived at such perfection in the matter of gutta-percha insulation as to leave nothing better to be desired, "it being quite sufficient to ensure good signalling through long lines of cable." But surely, with all deference to so eminent an electrician as Mr. Varley, we may be allowed to pronounce this a very lame and unsatisfactory conclusion to come to. Do we then arrive at such a state of perfection in anything as to have no desire for a still greater perfection? Assuming the truth of the statement, that the improvement made in the quality of gutta-percha to be as ten is to one what it was a few years back, still, the question is not to what degree of proficiency can we insulate a wire with this substance; but rather, how does it stand relatively as compared with the best india-rubber insulation? Is it better? or inferior? or what? The enthusiastic adherents of the former are bound to afford us proof of their assertions from actual experiment, and until they do they must be content to be met with incredulity on a matter which rests at present on bare assertion merely.

That india-rubber is much superior as an insulator to gutta-percha is further confirmed by the testing of the samples sent to the Indian Board as proposed cores for the Persian Gulf cable now making. In that case, as I have been informed on unimpeachable authority, the india-rubber samples exceeded those made of gutta-percha by fully 50 per cent. If I am wrong in this statement, now is the time for those who can to set me right, and so vindicate the course taken by the Indian Board and its engineers before the world; and until they do, they must rest under the stigma of having chosen a method of insulation which their own instituted experiments condemn.

Well, then, to what does all this lead as applied to the proposed Atlantic cable? Why, indubitably, that its core will be of gutta-percha also; this is inevitable; its engineer is an enthusiastic devotee of gutta-percha interests; and the incongruous elements that make up its consulting committee are, with one exception, the same. Its chairman, strangely enough, is G.P. to the backbone, so is its secretary; and, indeed, I may say, all in authority; and yet mark the results of inefficient insulation in long lines of submarine cables. Electricians tell us that induction is the greatest difficulty they have to contend with; and Mr. Varley described a most exquisite little instrument invented by Professor Thompson, in order to record the exceedingly faint signals transmitted through the old cable, and without which it would have been impossible that the cable could have spoken at all. Now, this is a fact to bear in mind; it speaks volumes. I would ask, how much of this loss by induction was due to the insulating material used, for it is scarcely fair to attribute it all to bad workmanship and ill-usage. Another fact to couple with the foregoing—and which is worthy of being written on the tablets of the memory of every shareholder of the Atlantic Cable—is, the Government committee recommended caoutchouc before all other materials, mainly on account of its *less inductive capacity*; nor does it require any one to be initiated into the mysteries of electrical science in order to understand that a high inductive capacity means so much waste electricity, and that the longer the line the feebler the current becomes until, if it be sufficiently long, a shadow of the original charge will hardly be left to announce that a message is in course of transmission. Mr. Varley, ever sanguine, estimates that he should be able to signal through the Atlantic cable made of a given quantity of copper, insulated to a specfic diameter with gutta-percha, at the rate of from 10 to 12 words per minute. Assuming that he could (an assumption, by the way, which few would feel disposed to make without a liberal discount), what is the inference? Manifestly, that a cable perfectly insulated with india-rubber could be worked through at the rate of from 15 to 18 words per minute, simply because the latter insulation is precisely 50 per cent better than the former.

But, whether Mr. Varley's calculations be reliable or not, this cable of all others is not the one that will admit of being constructed on suppositions and unsatisfactory data; especially with respect to its insulation. We have not to deal with a comparatively short cable of some hundred miles or so, but one unbroken line of upwards of 2,000 miles. In the former case, althongh desirable to secure the best, the question of loss by induction, owing to the inferior quality of the di-electric, is of comparatively trifling importance; whereas, on the other hand, the longer the length the more formidable the evil becomes in the ratio, as mathematically expressed by all electricians. Every existing cable, without an exception, is a practical illustration of the truth of the foregoing. We are justly proud of our success, and are not ashamed to own ourselves humiliated by so many repeated and inexcusable failures. But, important as our achievements have been, we cannot boast of aught but the most ordinary and make-shift insulation. The Malta and Alexandria cable, the longest in being, can only be signalled through at the rate of from four to five words per minute. The Toulon and Algiers, before it broke down, was but little better, and so of all the rest; and for this slow rate of signalling we have to thank the material used as the di-electric; in other words, gutta-percha. Besides, the higher the inductive capacity, and the consequent escape of electricity by this means, the more the insulation becomes impaired thereby, until finally it will result in the total collapse of the cable, providing that undesirable event be not hastened by other fundamental errors in the construction. In short, the whole question of success or non-success of submarine telegraphy turns upon the all important point of insulation, and is the main thing to be considered, although we should by no mears shut our eyes to other requisites—as lightness, improved methods of submersion, &c. We are not justified in prognosticating failure, if the predilections of the chairman, the engineer, and others foremost in the Atlantic Telegraph Company, are acted upon in the construction of this cable; but surely this company will think twice ere they risk another half million in a speculation which neglects to secure itself against anything and everything that in the remotest degree has the appearance of leading to non-success; but time will prove whether they are really as wise as we would feign hope; despite present appearances, they are.

PHILO.

ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS, AND FOR EFFECTING ECONOMY IN THE RAISING AND USE OF STEAM.

THIS association has just issued its annual report. The report is so full of valuable information that we deem it advisable to give it to our readers almost extant. After some introductory observations on the character of the boilers examined, Mr. L. E. Fletcher, the chief engineer, says:—

Before entering upon the detailed consideration of the defects detected on the examinations, it may be stated, that a gradual improvement is found to be going on in the general character of the boilers under inspection, as well as in the arrangements of their fittings. The new constructions are marked with more simplicity and accessibility of parts and fittings, and can be more readily attended to by the engineer in charge, as well as more satisfactorily examined by the inspector, and entail much less anxiety in answering for their safety. Notwithstanding this general improvement, however, the defects ascertained this year are more numerous than those of last year; this may be accounted for by the increased number of "thorough" examinations previously referred to, which have revealed defects otherwise unknown; an additional illustration of their importance.

The defects discovered in boilers are mainly of two distinct classes—one relating to their construction, and the other to their condition.

Under the first head, namely, that of construction, 196 recommendations have been made, which are as follow:—

In 153 boilers the internal flue-tubes have been recommended to be strengthened by hooping.

In 18 boilers the shells have been recommended to be strengthened at the steam dome by stays of angle iron, &c.

In 9 boilers the shells have been recommended to be strengthened at the ends.

In 16 boilers the load on the safety-valves has been recommended to be reduced.

The following are those defects appertaining to the second head—namely, that of condition. Of these, 85, which are as follows, were considered dangerous:—fractures of plates and angle irons, 13; blistered plate, 1; furnaces out of shape, 12; corrosion, 37; defective safety-valves, 5; defective water-gauges, 9; defective feed apparatus, 1; defective blow-out apparatus, 7.

Others not actually dangerous, but still unsatisfactory, are as follows:—fracture, 60; blistered plates, 19; furnaces out of shape, 33; corrosion, 270; safety-valves irregularly loaded and otherwise out of order, 94; water-gauges out of order, 135; pressure-gauges out of order, 76; feed apparatus out of order, 35; blow-off apparatus out of order, 224; fusible plugs out of order, 49; also two instances of deficiency of water.

It may be added that many of the above defects were observed at visits made early in the year, and since that time many of them have been repaired.

To some of these defects more detailed reference may be made.

FRACTURE.

One of the most fruitful sources of fracture in boilers is the unequal expansion and contraction of their different parts, on account of the various temperatures, which are caused, in many cases, though not in all, by imperfect circulation of the water.

This has been kept in view so constantly in previous reports, that little more now is necessary than an enumeration of any additional facts, which have lately come under notice.

It may, therefore, briefly be stated that grooving still continues to manifest itself in double-flued boilers at the tube angle irons and end plates, more especially at the furnace mouth; and is more active in proportion as the end plates are rigidly stayed. In no class of boiler, however, is this action found to be so destructive as that in which the furnace tubes are brought so close together; that there is not room for the angle iron at either end of the flue to be carried completely round them; and is, therefore, supplemented by what is called a "saddle-plate," which, with its complement of the two partial angle iron hoops, forms a "spectacle-piece." These "saddle-pieces" are found to groove so deeply that in some cases the whole thickness of the plate becomes eaten through. There is no satisfactory cure for this but their entire removal, and the tapering down of the flue-tubes at the mouth, so as to increase the intermediate space.

Channelling at the transverse seams at the bottom of the shell of internally fired boilers, is still met with. It generally is discovered in the bottom external flue, on the outside of the plate immediately at the edge of the overlap, being deepest at the centre or "keel" line, and dying out in about 15 inches on each side, but very frequently in much less. In one instance, however, it was found on the internal surface of the plate, and to be situated as high as the side wall on which the boiler was set.

On the whole a gradual improvement, both with regard to channelling at the bottom seams, and grooving at the end plates and angle irons, is taking place in the boilers under inspection. This improvement is due, with regard to the former, to the more general adoption of means for heating the feed water, as well as to the boilers being now more frequently set, so that the heat from the furnace flues passes immediately under the bottom, and then lastly along the sides, by which means the circulation of the water is improved; while, with regard to the latter, the improvement is due to the fact of the end plates being now less rigidly stayed, and thus, as has been stated in previous reports, having room to "breathe."

Boilers with two furnaces running into a single oval flue, containing a number of vertical water tubes, have the advantage of a more rapid circulation of the water, which is decidedly calculated to prevent both transverse channelling at the ring seams and grooving at the angle irons. There are, however, but a small number of these boilers under inspection, in proportion to those of the double-flued class; but, as far as observation has been made, they certainly appear to compare favourably, on the above points, with their competitors. Water tubes have also been added in a few cases to ordinary double-flued boilers, being fixed behind the fire-bridge with a view to promote circulation, while, with the same object, a new boiler has lately been brought out, in which water pockets or mid-feathers at varying angles are fixed in the flue-tube, with a view of securing it against collapse, and at the same time promoting circulation of the water.

Other cases of fracture have occurred from fixing angle iron strengthening hoops to flues in an improper manner. This has been so fully gone into in the printed abstract of the monthly report for June last, and which was circulated amongst the members, that nothing need now be added beyond stating that several additional cases have since been met with of plates at the crowns of furnace tubes becoming burnt and cracked, when the thimbles or ferrules between the plates and angle iron hoops, explained in the above report, have been omitted.

Other cases, again, of fracture, have been caused by the flue-tubes and shell being bound together by a cross stay in the middle of their length, when, from the unequal expansion of the two, one has injured the other.

One case of fracture has been met with in an externally fired boiler, which occurred at one of the transverse seams of rivets, from the sudden cooling of the plates, by the too hasty introduction of a quantity of cold water immediately after blowing out, while very similar injury has arisen at the transverse seams over the furnaces in other externally fired boilers when in work, and, in addition, several of their plates have both bulged and blistered. Boilers externally heated by the flames passing off from iron furnaces have been found to be specially liable to start at the seams, and crack at the rivet holes, at the point where the flame impinges.

A boiler with two internal furnaces, as well as an external one beneath it, added with a view to promote circulation of the water, was found to bulge in the plate of the external shell over the fire, while the internal furnace tubes remained uninjured. It is thought that this boiler, from the fact of its combining within itself the two classes of firing, viz., internal and external, affords an apt opportunity of comparing the merits of the two systems, while the result just recorded is fully borne out, by a more extended observation of other boilers.

BLISTERED PLATES.

This subject has been somewhat anticipated under the previous heading, and it will now, therefore, be only necessary to point out, that the fact of plates, by good makers, being liable to blister unawares, and which previous examination evidently fails to detect, shows the importance of not hazarding an explosion upon their soundness. Thus the strength of no unassisted plate, exposed to the action of the fire, should be relied on; and, consequently, it becomes most desirable that furnaces should, in every instance, be stayed either by flanged seams, or with hoops of angle iron, T-iron, or other advantageous form.

FURNACES OUT OF SHAPE.

The general causes of shortness of water, from which overheating and injury to the furnace crowns ensue, are found to be as follows:—

1. The direct neglect by the engine-tenter of the feed apparatus, which is too obvious to need remark, and too glaringly careless to be otherwise than exceptional.
2. False indication of the glass water gauges.
3. Loss of water at night on account of leakage of the blow-out apparatus, sometimes from its being carelessly and imperfectly closed.
4. The lighting of fires by night watchmen, and others, without any water in the boiler.
5. Blowing the water out of the boiler with the fire still left in it.

An efficient low water safety valve, which would—on the sinking of the water below its proper level—relieve the pressure of the steam, would evidently save the furnaces under some of the above circumstances, though not under all.

It should be added, that some furnaces are out of shape from their first construction, being found on actual measurement to be as much so as one or two inches, merely from careless workmanship, which passes unobserved until detected on inspection. This inaccuracy considerably weakens the flues, especially when the major axis is horizontal, since the natural tendency of all furnace tubes is to collapse vertically.

CORROSION.

Corrosion is found to be going on in all boilers more or less, and it will be seen that the greatest number of dangerous defects in the preceding list are to be found under this head. A few instances may be given. In one case, a boiler set upon a mid-feather wall, 15 in. thick, had a channel eaten right along it about 8 in. wide, which ran down the centre of the seating, while the plate at the edges of the brickwork appeared quite sound, and the danger consequently passed for some time unsuspected. In a second instance, with a mid-feather 2 ft. wide, the plate was found to be eaten almost through from nearly one end of the boiler to the other; while in a third, where lime had been allowed to come in contact with the boiler at the mid-feather, the plate was completely pulverized, and could be carried away in handfuls. In a fourth case, a vertical tubular boiler had been placed close to a wall, one part being in actual contact. Damp in the brickwork set up corrosive action in the plate, which, being concealed by the position, went on undetected until the metal was completely eaten through, and a piece blown out by the pressure of the steam. The original plating of the boiler was thick, the pressure low, and the corrosive action local, only affecting a surface of about 12 in. square, so that the rent did not extend.

A fruitful source of corrosion is found in the leakage of blow-out pipes at their attachment to the shell, while in some cases the pipes themselves are fractured, and continue so for some time unawares, the leakage meanwhile playing on the bottom plate, from which corrosion necesarity ensues.

Examples of corrosion might be multiplied indefinitely; enough, however, has been said to show the importance of having all parts of the boiler accessible to examination, the flues sufficiently capacious, and the seatings as narrow as possible, and also of having the brickwork removed occasionally, at all events in places, so as to ascertain the condition of the plates, since to conclude that the parts concealed are in the same condition as those in view, has been found in practice to be fallacious.

The examples of corrosion, previously referred to, have all been external, and caused in every case by moisture, arising either from leakage or damp in the flue. Internal corrosion is not generally so dangerous, and arises from acidity in the water. Many members are now using carbonate of soda, and all those who do so, speak highly of it. Even the Manchester town's water is improved by the introduction of a slight quantity. This water is not found to be dangerously corrosive, but to speckle the plates over minute indentations, in some cases depositing small scales, like miniature flattened walnuts, about three-quarters of an inch in diameter, and one-eighth of an inch thick. These, on being severed from the plate, leave behind them shallow prints on its surface. One firm, having several 50-horse power boilers, and which are fed with Manchester town's water, uses half a pound of soda in each per diem, and finds this quantity sufficient to neutralize the acidity.

DEFECTIVE SAFETY VALVES.

Reckless or even careless overloading is now seldom if ever met with in the boilers under inspection, though some cases have come under notice of most defective arrangements in new boilers, the safety-valves being placed on the steam-pipes instead of directly on the shell, so that the communication between them was contingent upon the junction valve being open.

Many safety-valves are found improperly loaded, that is, insecurely so, and with loose irregular weights. Importance is attached to safety-valve levers being loaded, with but a single suitably-adjusted weight at their end.

The attachment of internal loading to dead-weight safety-valves has, in some cases, been found most insecure. This is a point, from the concealment of the weights and links within the boiler, which is likely to escape attention, though serious scalding would ensue in a confined boiler-house in case of the valves suddenly breaking loose. Of internally loaded dead-weight valves, those are the safest which are boxed-in and fitted with a hand-lifting lever, and a discharge pipe for the waste steam.

WATER GAUGES.

The recommendation previously given to fix duplicate water gauges to every boiler, and to have the passage in the necks as large as possible, can only be repeated, in the present instance, with the additional force which another year's inspection gives, and many furnace crowns would have been saved by the timely adoption of these simple precautions. The taps of glass water-gauges are almost always found to leak; this can be greatly remedied by having them fitted with nut-glands packed with a little cotton, while the grit, which so soon cuts away the plugs, would be much lessened by the adoption of surface blowing-out.

PRESSURE GAUGES.

All the pressure-gauges fixed to the boilers under inspection are checked by a standard indicator at each of the inspector's visits, provided that the boilers are fitted with the necessary tap. Thus the accuracy of most of the pressure-gauges passes constantly under review.

Generally, they are found to indicate too high a pressure. but, in some cases, as much as from ten to fifteen pounds too little; the first error leading to their being disregarded, and the second to actual excess.

The pressure-gauges under inspection are, with but a few exceptions, of four classes, namely, the natural mercurial column gauge; the mercurial differential gauge; the dial gauge; and the compressed air gauge.

The natural mercurial column gauge stands first upon the list for accuracy, as its simple and direct construction would indicate.

The differential mercurial gauge is of inverted syphon construction, the short leg being of larger diameter than the long one, and thus the mercury has less travel in the former than in the latter. The indications of pressure are read off from the short leg, which considerably reduces the length of the index scale of pounds, and those of the best class of this gauge are very legible. In one class of differential gauge, however, the mercury enters the glass indication tube, which becomes very much discoloured in consequence. and, in some cases, quite opaque; while, at the same time, the glass stands off so far from the index face, that it can only be read accurately when the eye is placed on a level with the upper surface of the mercurial column. In another class of this differential gauge the mercury does not enter the glass tube at all, but the pressure is indicated by a floating pointer, so that no discolouration of the glass takes place, and the gauge is always legible.

Dial gauges are very compact, and can be fixed directly in front of the boiler, just in sight; while those of the best class are very legible; care should be taken, however, not to fix them too near the boiler face, or else to put a piece of wood between the two so as to prevent their becoming heated, or otherwise their indications will be affected.

The compressed air gauge, in which a syphon column of mercury, as a piston, acts upon an air cushion, is found to be universally incorrect, and is quite unworthy of confidence.

In conclusion, while the natural mercurial column gauge must be allowed to stand the highest for abstract accuracy, yet the best description of the mercurial differential column gauge, as well as that of the dial gauge, are but slightly inferior to it practically, and are more easily read; while the dial stands pre-eminent for compactness, especially at high pressures, which becomes of importance in a long series of boilers, when each is fitted, as it is always desirable should be the case, with its own independent gauge.

DEFECTIVE BLOW-OUT APPARATUS.

It has already been stated, under the head of "Corrosion," how much injury is frequently done to the bottom plates of boilers by defective joints of the blow-out pipe; to remedy which, a short block should be rivetted to the boiler, and the pipe bolted to it instead of direct to the shell. These pipes, which are generally of elbow-shape, should not be bound by the brickwork, since the settlement of the boiler is apt to strain them, and cases have occurred in which they have been fractured in consequence. From this, in one instance, considerable corrosion ensued; and in another, not under the inspection of this association, in which the fracture was sudden and complete, scalding resulted to two or three persons.

Many blow-out taps are dangerous to use for want of suitable discharge pipes to carry off the waste water, and, in some boilers, the water spaces have been found to be completely choked with sediment, from neglect of the most simple precautions with regard to the use of the blow-out apparatus. This subject has been so constantly alluded to, that repetition would be tedious, though, perhaps, hardly unnecessary; it will, therefore, only be added that brass gland taps, recommended in previous reports, are still found to give satisfaction, and to be more certain in their action than either sluice or mushroom valves.

INCRUSTATION.

Some advance has been made during the past year in the prevention and removal of incrustation, although much yet remains to be done. It is too frequently concluded that incrustation and corrosion are not to be found in the same boiler, and that the plates beneath the scale are protected. Such, however, is by no means found to be universally the case, and frequently, on removing the scale, grooving, or other evidence of corrosion, is discovered on the surface of the plate beneath it. An inspection of a boiler, therefore, coated with incrustation, must always be unsatisfactory; not to mention the injury to the boiler itself, as well as the loss of heat that results from it.

The remedy adopted for this evil, in marine boilers, namely, "surface blowing-out," has been during the past year frequently brought before the attention of the members, and a drawing made of a simple un-patented arrangement, and placed at their disposal. A very considerable number have availed themselves of this, while, as many of the manufacturing engineers as have wished to do so, have furnished themselves with copies. In consequence of this, several of these scum pipes have been applied, the exact number is not known, but one firm among others may be mentioned, who have fixed one of these scum pipes to each of their nine boilers, and with the most satisfactory results.

This is not, however, the only description of scum pipe adopted. The subject of "surface blowing-out" has been taken up by others, and two varieties of apparatus patented, and somewhat generally introduced. It is thought that this diversity will rather prove of advantage than otherwise; and now that the general principal of "surface blowing-out" has been called attention to, the more individual ingenuity is directed to the details of the apparatus the better. A more minute reference to the construction of these scum pipes was made in the monthly abstract of October last; and now that these three classes have been in operation for some time, it is thought that the results of their working may shortly be made a matter of comparison, which, as soon as opportunity offers, will be communicated to the members.

The use of soda, for the prevention of incrustation, is found of considerable advantage, and increasingly adopted. It is, however, better introduced in small regular doses, than in large in-frequent charges. In many cases there might be fitted to the suction pipe of the feed pump a funnel mouth, by means of which the requisite charge could be introduced to the boiler without difficulty; its rate of ingress being regulated by a tap between it and the suction pipe. In some cases a separate feed pump has been adopted, fitted with a small cistern containing a day's supply, and this arrangement has been found to work most satisfactorily.

In conclusion, there are but few cases of incrustation which the use of soda, combined with regular blowing-out from the surface of the water, will not check.

CONSTRUCTION OF BOILERS.

The consideration of the previous defects, to which the boilers under inspection have been found to be liable, will, it is trusted, prove of assistance to members wishing to lay down new boilers, as well as to those whose business it is to construct them.

But it is thought, however, that a further service yet might be rendered. Such ample opportunity has been enjoyed of seeing when in work, as well as of examining while at rest, considerable numbers and varieties of boilers, and such full information has been collected with regard to them by the association, that it is thought if the best proportions were collated, and put together in the form somewhat of a specification, it would prove of more assistance still than observations and analyses of defects alone; not by any means a minute and technical specification, but a systematic explanation of such proportions as have been found to exist in those boilers, giving the best results, and needing the least repair. It was intended to include this in the present report, but, finding that it could not be given complete, it is reserved for insertion in the printed monthly reports which circulate amongst the members.

EXPLOSIONS.

It is to be regretted, that no means exist of ascertaining the whole number of steam-boiler explosions that occur throughout the United Kingdom, and there can be no doubt that many are never recorded at all. There are known, however, to have occurred during the last year, no less than 30 explosions, from which, at least, 87 persons have been killed, and 89 injured. Of the number of lives lost by some of the above, no account could be obtained; while, from one of them, as many as 29 persons were killed, and 12 injured; from a second 12 were killed, and 24 injured; and from a third, 6 were killed, and 8 injured.

The following list gives the description of boiler to which the explosions have occurred, with the number of each class, as well as of the persons killed and injured :—

Four haystack boilers—12 persons killed, 5 others injured.

Six plain cylindrical egg-ended boilers—6 persons killed, 6 others injured.

Three iron-works' boilers—47 persons killed, 44 others injured.

Three plain single-flued Cornish boilers—2 persons killed, 3 others injured.

Two plain double-flued Lancashire boilers—4 persons killed.

Three locomotive boilers, of tubular construction—4 persons killed, 5 others injured.

One agricultural boiler, of tubular portable construction—4 persons killed, 4 others injured.

One kitchen-range boiler—1 person killed.

Also seven other boilers, of the construction of which no reliable information could be obtained, and from the explosion of which, 7 persons were killed, and 22 others injured.

The haystack boilers, referred to above, were externally fired, and exploded through the failure of the part exposed to the action of the fire.

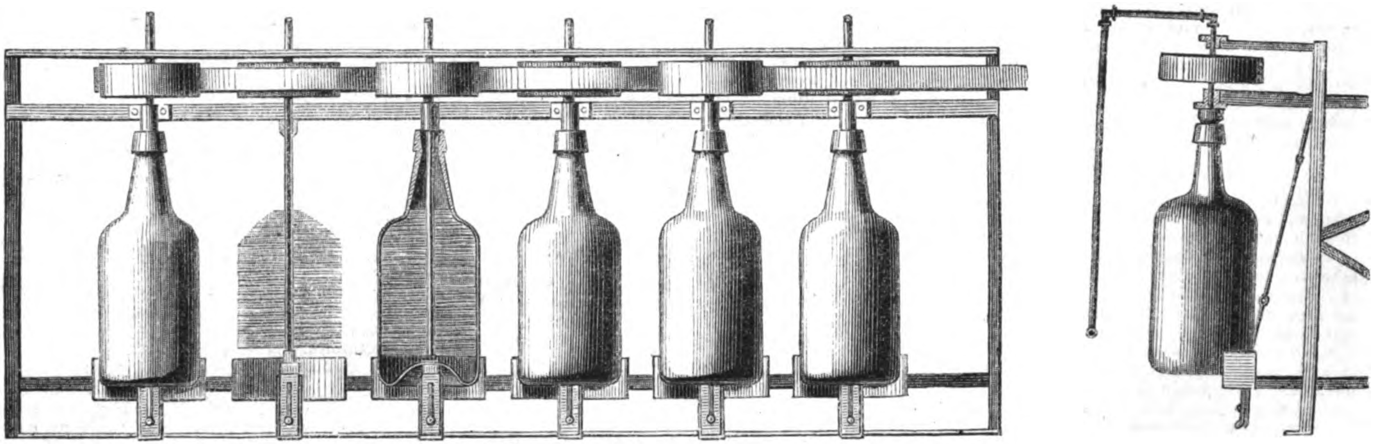
The plain egg-ended boilers, fired underneath, were found, in all cases, to have exploded from the rending of the transverse seams of rivets. One of these boilers exploded at the bottom of a coal mine, and in another case three boilers working side by side exploded simultaneously. Details of all these have already been reported in the monthly abstracts for February, March, and August, respectively, so that further particulars need not now be given.

The iron-works' boilers, were all heated by the flames passing off from the iron furnaces, which played not only upon the external shells of the boilers, but also through their internal flues.

The first of these was what is termed an "upright furnace" boiler, in which the flames, passing off from sometimes as many as four iron furnaces, impinge upon the exterior, and then pass into an interior descending flue. In this case the crown of the descending flue collapsed from original defective construction.

The second explosion occurred to a precisely similar boiler, but in this case the external shell gave way at the seams, upon which the flames from the iron furnaces impinged.

GILBY'S BOTTLE-WASHING APPARATUS.



Front Elevation.

Side Elevation.

The third boiler was a plain single-flued "Cornish" one, fired externally by the flames passing off from two iron furnaces, and internally by those passing off, through its flue tube, from another. The explosion was caused by collapse of the internal flue-tube, arising from defective construction, and might have been prevented had the flue been strengthened, either with flanged seams, or hoops of angle iron, T iron, or other suitable form.

Each of the three iron-works' boilers, was personally examined subsequently to its explosion, and full particulars were given in the March, April, and December monthly abstracts.

Of the three explosions which occurred to plain "Cornish" boilers, one was caused by collapse of the flue-tube, consequent upon shortness of water. This appears to have been caused by carelessness, the gauge-glass having been broken. The shell of the boiler was uninjured, and the only damage done was by the percussive action of the steam and water, in a direct line with the furnace tube.

Of the other two, no reliable information could be obtained; they are reported, however, to have failed at the front end plate.

Both the explosions, which occurred to boilers of the plain double-flued "Lancashire" class, were caused by external corrosion of the plates, which were so eaten away in one case as to be reduced in thickness to the sixteenth of an inch, and in the other to that of a sheet of paper.

One of these boilers was under the inspection of this association, but the opportunity had not been afforded to its inspectors of making the regular annual "thorough" examinations, the importance of which has been so repeatedly called attention to in the reports. This subject was gone so fully into in the monthly report for July last, shortly after the explosion happened, that it is needless to repeat the details here; while the particulars of the other, which also was personally examined, will be found in the monthly report for last December.

The locomotive boilers, in every case, exploded from thinning of the plates, caused by internal corrosion, it being a general practice in the management of locomotives only to make a thorough internal examination of the shells of the boilers, when the flue-tubes are renewed. This, in some cases, has allowed an interval of as much as seven years to elapse between one examination and another, during which time the boiler has been working in a state of complete uncertainty, the actual condition of the plates being unknown. The use of the hydraulic pressure is objected to by several locomotive engineers, though not by all; it is a point which has provoked a good deal of discussion, and is too lengthy to enter upon, on the present occasion. It may, however, be stated, in brief, that no case has been met with, in the experience of the association, in which injury has resulted from the judicious application of this test, and also that no opportunity will be lost of contributing any information on the subject that the experience of the association may afford. It is one of considerable interest, and affects the safety of the whole travelling public.

The kitchen-range boiler exploded from accumulated pressure, the taps of both the inlet and outlet pipes being closed at the same time, in consequence of which there was no escape for the steam, there being no safety-valve.

Of the cause of the explosion of the agricultural portable boiler, as well as of those which occurred to the remaining seven at the bottom of the list, no reliable information has been received, while the distance at which nearly all of them happened precluded personal examination.

The causes of the above explosions may be systematised as follows:—

Of 30 explosions, which happened during the year 1862, 11 occurred to externally fired boilers from failure of the plates exposed to the action of the fire; 3 resulted from internal corrosion, and 3 from external; in addition to which, 4 were due to improper original construction, one to shortness of water, and another to accumulated pressure through want of a safety-valve; while 7 occurred at a distance which precluded a personal investigation of their causes, at the same time that no reliable information could be obtained with regard to them.

It may be added that the explosion, which occurred to a double-flued "Lancashire" boiler, and from which one life was lost, is the third fatal explosion which has happened to any of the boilers under the inspection of this association, since its establishment eight years ago; to which should be added three cases of collapse of furnace flues, not attended with any serious consequences, and which arose in two instances, if not in all three, from shortness of water. During this period 712 dangerous defects have been pointed out in the boilers under inspection, from which serious injury might have arisen in each case; while, upon limited inquiry only, it has been found that no less than 213 explosions have occurred in that time to boilers not under the inspection of this association, which have been attended with the loss of 472 lives, in addition to serious injury to 512 persons, and considerable damage to property.

ENGINES.

The depressed state of trade during the past year has so disorganised the ordinary working of most of the mills, that it has been found impossible to draw up a reliable comparative table of the economic duty of the engines. Indicator diagrams alone, however, from most of the engines under inspection, never afford the necessary data for correct comparison, since so much steam is drawn off for purposes other than that of motive power. It becomes, therefore, highly desirable that water metres should be fixed to each series of boilers, so as to ascertain the amount of water evaporated. This would enable a comparison to be made of the evaporative power of different boilers, and of the value of different coals, while at the same time the diagrams would afford an indication of the working of the engines.

Two pair of engines, built during the past year, have had their cylinders fitted with steam jackets; and a superheating apparatus, for raising the temperature of the steam in its passage between the boiler and engine, has been introduced in two or three instances. The object of both these arrangements is economy of fuel, and it is intended, as soon as possible, to investigate the results obtained, in order to communicate them to the members.

A "surface-condenser" is being constructed for a pair of beam-engines, and will, it is expected, be put to work early this year. "Surface-condensation" is the most radical preventative of incrustion, since, whatever the character of the condensing steam may be, this condensor returns to the boiler distilled water; the same quantity, with the exception of a small amount of waste, being used again and again. There are many cases in this district where this will prove valuable; and the results of the application in the present instance will be a matter of considerable interest to many of the steam users of the district.

CONCLUSION.

A very brief recapitulation may be allowed, in conclusion, of some of the points attained during the past year.

"Surface blowing-out" has made considerable progress. "Steam-jackets," so long discarded in this district, have been revived, and "superheating" introduced, while a "surface-condenser" is about to be applied.

Although these arrangements are not in general use here, they have been fully tested elsewhere, and it is thought that much may be gained by importing, as it were, into this district, the engineering experience of others. For instance, the "steam-jacket" has, in combination with the use of highly-expanded steam, been the principal element in the attainment of that economy for which the Cornish engine has for so long since been notorious, while "surface blowing-out" and "surface-condensation," as well as "superheating," are due to marine engineering practice, which has developed a higher economic result than that generally obtained in this district.

Although it is true that all really sound and beneficial mechanical arrangements, practised in one district, will, in time, surely find their way into and secure for themselves adoption in others; yet it is thought that this association can do much to hasten this process—too frequently a tardy one—by circulating, upon these points, information amongst its members; and to assist in doing which, as far as it lies in my power, will always be regarded by me, not only as a duty, but a source of satisfaction and pleasure.

It is trusted that, during the present year, the mechanical arrangements just referred to will be fully tested, and general confidence and adoption secured in this district, for such of them as prove worthy of it; so that the desire expressed at the conclusion of the last annual report may be realized, namely—"That no year may be allowed to pass, without a decided mark of progress being clearly stamped upon the engineering practice of the district, by this association." For the accomplishment of this, however, the co-operation of the members is absolutely necessary. Comparative returns of the working of engines cannot be made, unless the members have their engines indicated; neither can the consumption be calculated, without accurate returns; nor the evaporative power of the boilers arrived at without the application of water meters.

GILBY'S BOTTLE-WASHING APPARATUS.

AN ingenious arrangement of apparatus for washing bottles, and which we illustrate in the annexed engravings, has just been patented by Mr. A. Gilby, of Oxford-street. The arrangement consists of fitting a series of brushes upon a suitable frame, each fixed upon a hollow spindle, which, with the brush, revolves in the inside of a bottle to be cleansed, as clearly indicated. Through these hollow spindles, and by means of a pipe in connection with a suitable tank, a supply of water is carried into the inside of each bottle, an by the action of the brushes revolving is used to cleanse the inside of it. The bottle is placed slightly inclined from the horizontal plane, its mouth falling into a hollow metal boss, through and upon which the hollow spindle is mounted, and, with the brush surrounding it, is passed into the interior of the bottle. The bottom end of the bottle is laid upon a sliding seat, so as to regulate its position. The slide is held to its place by means of a spring, so that the bottle is steadied and held in its proper position during the operation. The hollow spindles, with the brushes, are caused to revolve by means of rollers, or pullies and straps, or by any other well-known motion. When complete, the frame upon which the whole is mounted is arranged so as to form a trough to receive the dirty water as it comes from the bottles after and during the operation.

PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS.

On the Manufacture of Hemp and Wire Rope.

By Mr. Charles P. B. Shelley.

(Continued from page 121.)

The rope laying machine for laying the hemp strands into rope is shown in Fig 5. The three spools A, filled with strand from the registered machine last described, are carried in the vertical spool frames B, which are centered at top and bottom in the main frame C of the machine. The entire machine revolves round the fixed centre shaft, and is driven by the small bevel pinion D gearing into the wheel E at the bottom of the main frame C. The spool frames B are made to rotate on their axes during the revolution of the machine by means of the pinions F on the spool frames and the counter wheels G gearing into the dead wheel H, which remains stationary, being fixed on the centre shaft of the machine. If the pinions F were of exactly the same diameter as the dead wheel H, the spool frames would make exactly one rotation on their axes for each revolution of the machine, and the spools would be preserved constantly parallel to themselves while the machine revolved, so that the strands would be laid into the rope without any additional twist in the individual strands. But in order to ensure the yarns in each strand being thoroughly closed upon one another, a slight additional twist or "forehard" is given to each strand in the act of laying it into the rope, by making the spool frames perform rather more than one rotation on their axes for each revolution of the machine, since the twist of the yarns in each strand is in the contrary direction to the twist of the strands in the rope. The pinions F on the spool frames are, therefore, made of smaller diameter than the dead wheel H, in the proportion of 13 to 14. From the spools A the strands are drawn off round the stretching pulleys I I, as shown dotted in Fig 6, which are driven by bevel gearing and pinions J from a dead wheel fixed on the centre shaft at the top of the machine, with counter wheels and pinions K similar to those at the bottom. The strand is pressed tight into the groove of the upper stretching pulley I by the small tightening pulley L, Fig. 6 and 7. The spool A is retarded from unwinding too fast by a friction break, which is adjusted to any degree of tightness required. The strands pass up through the hollow bearings at the top of the spool frames B and through the pinions K, and are curved over the oblique guiding rollers M, which are fixed at varying inclinations, in order to prevent the strands from slipping off. The three strands then unite at the centre and are laid together into the rope by the revolution of the machine, each strand being laid into the rope with the required amount of "forehard" by the simultaneous rotation of its own spool frame in the contrary direction to the machine. The newly made rope is carried upwards to another machine, where it is stretched over and under three pulleys driven by steam power; and as it passes from the last pulley it is compressed by a roller kept against the rope by a strong steel spring. It is afterwards finally coiled away in a warehouse.

There were three rope-laying machines at Devonport Dockyard, and they were calculated to make about 3,000 tons of cordage per year of 313 days. Of this amount the largest machine would make 2,000 tons of cables and hawsers of large size, the cables ranging from 14 to 24 in. girth and the hawsers from 7½ to 12½ in. girth; the second machine of intermediate size would make 700 tons of cable-laid ropes from 8 to 16 in. girth, and hawsers from 5½ to 7½ in. girth; and the smallest machine would make 300 tons of cablets from 5½ to 7½ in. girth, and shroud-laid ropes from 3½ to 5 in. girth. The average cost, including all charges of the establishment, engine power, repairs of machinery, &c., is said not to have exceeded 17s. 4d. per ton of cordage made, when the whole machinery was employed to the fullest extent of its capability; the cost by hand at the same period being stated to be 24s. per ton.

The strength of hemp rope varies considerably, and depends principally on the quality of the hemp from which it is made, the number of yarns composing the strands, and the manner in which the ropes are laid. The average strength of each yarn in hawser-laid ropes is found to be greatest with the smaller sizes of ropes. Shroud-laid rope made with four strands is about one-fifth weaker than hawser-laid made with three strands, on account of the additional twist or "hard" which is given to the shroud-laid; and cable-laid rope is about one-third weaker than hawser-laid rope. The strength of these three different lays is, therefore, in the proportion of cable-laid 10, shroud-laid 12, and hawser-laid 15. The relative breaking weights of ropes made from the three most ordinarily used materials are stated to be as follows:—taking the breaking weight of St. Petersburg hemp rope at 100, that of Italian hemp rope is 107, and that of Manilla rope 73. Tarred rope is weaker than untarred, other circumstances being the same; for the quality of the tar seriously affects the strength of the rope. Hence the strongest ropes are hawser-laid or three-strand ropes made of untarred Italian or Russian hemp.

Wire rope.—The second branch of the subject of the present paper is the manufacture of iron wire rope, which, although at first made by hand, is now made exclusively by machinery.

Wire ropes were used as early as 39 years ago for the supporting cables of a suspension bridge at Geneva; and also for the Freiburg suspension bridge of 807 ft. clear span, erected 27 years ago. The wire ropes in the latter case, shown in the engravings, are constructed of 20 bundles of strands of straight iron wire 0·125 in. diameter, stretched parallel, forming a rope 5½ in. diameter, and bound round with wire at 2 ft. intervals.

The first form of wire rope regularly manufactured was made about 27 years ago, and was known as "selvagee." It consisted of a number of hard or unannealed wires, of about 12 to 16 wire-gauge or 0·110 to 0·065 in. diameter, which were stretched parallel and bound together by a fine wire of about 20 wire-gauge or 0·036 in. diameter, wound spirally around; after which, a "parcelling" of woollen list was also wound round in the contrary direction, with the edges lapped so as to cover the wires entirely; the rope was completed by a service of tarred yarn wound on in the contrary direction to the list. The method of making the rope was simply to warp or stretch the wires at a uniform tension over two hooks set at the distance of the length of rope required to be made, passing the wires backwards and forwards over the hooks as many times as was necessary to make up the size required. A solution of india-rubber boiled down in linseed, with a mixture of resin and tar, was rubbed carefully into the body of the rope, previous to binding up; and after the binding wire had been wound on, the solution was again applied to the exterior wires to prevent oxidation, the process of galvanizing being unknown or not practised at that time. The "parcelling" of list was also saturated with the solution, the yarn being tarred as usual. The binding and parcelling were always done by hand, before the rope was taken off the hooks; but the service of yarn was usually laid on by a machine for that purpose, though occasionally also by hand. The method of attaching the fittings, such as shackles, thimbles, and dead eyes, was either by forming an eye during the process of warping to receive them, or by inserting the end of the rope stripped to the wires into a conical socket attached to the shackle, and turning back the ends of the wires so as to prevent the rope being drawn out. But more generally the fittings were "turned in;" that is, the end of the rope was doubled round and "seized" or bound to the standing part. It will be seen that it was very difficult to splice this form of rope, owing to the absence of twist or "lay."

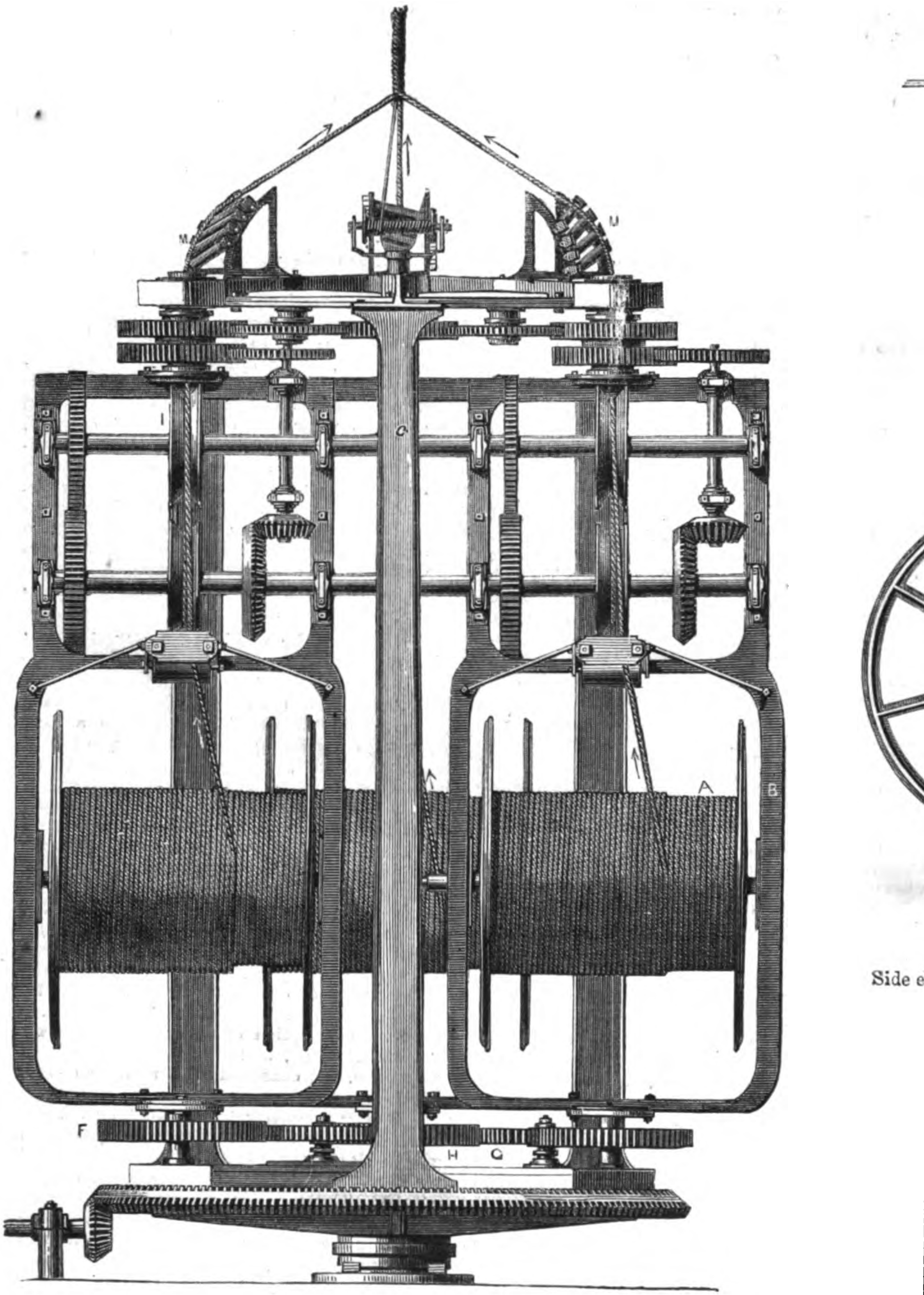
Ropes thus made were exceedingly rigid and non-elastic, but possessed greater strength than any other construction; in fact, the entire strength of the wire was preserved. The "parcelling" and "service" added to the size, but not at all to the strength, being intended only for protecting the wires. The want of elasticity and pliability, together with the difficulty of fitting, and the constant wear of the "service" of yarn, acted somewhat prejudicially against the introduction of this first form of wire rope on an extensive scale; yet it was used in the royal navy and mercantile marine, and also for suspension and tension bridges: for the latter purpose it is still used, especially in California, where a large number of wire rope suspension bridges are now being erected to replace those destroyed by the late floods.

The machinery for making these "selvagee" ropes consisted simply of the two hooks over which the wire was warped, which were attached to moveable posts set at the required distance asunder. The "serving" machine was a long wood trough extending nearly the entire length of the rope ground, having a revolving shaft at each end with a hook at its extremity, and carrying a fast and loose pulley, over which a driving band passed. The two serving hooks were driven at the same speed of about 400 revolutions per minute: and the shifting forks of the driving bands were connected by a cord extending throughout the length of the ground, so that the workman could stop or start the machine at any part. An ordinary serving mallet was employed for laying on the yarn, and was guided by the workman who also regulated the tension, the yarn being supplied from reels hung overhead.

The next description of wire rope was known as "formed" rope, and was introduced about 25 years ago. It consisted of a number of soft or annealed wires, usually about 14 wire-gauge or 0·085 inch diameter, "formed" or twisted into a strand, but with little or no regard to regularity: and four of these strands were "laid" into a rope, though this number was not always the same. The number of wires was varied according to the size of rope required, and occasionally the size of wire was altered to suit circumstances. These ropes closely resembled ordinary hemp ropes in appearance. The twist caused by "forming" the strands remained in the wire as a permanent set, and the strands were "laid" together with an extra amount of twist or "forehard" in each strand, which was necessary to keep the rope together. Little or no injury was done to the wire by this process, owing to its being annealed, and also from the length of the twist of the wires in each strand, which was usually about 12 inches pitch; but it would be almost impossible to use hard wire in this manner.

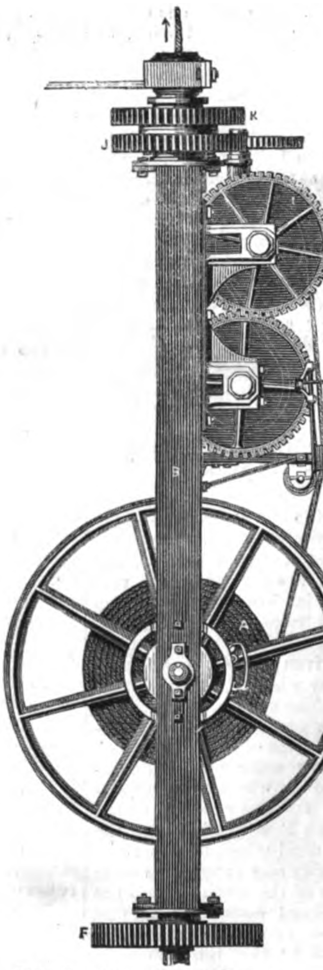
The "formed" wire ropes possessed great pliability and some amount of elasticity; they were readily spliced and fitted, like ordinary ropes, and though not so strong as the "selvagee" wire ropes, they possessed many advantages and were more easily introduced. Their adoption for rigging, incline, and traction ropes, became extensive; and this construction was the first wire rope used on the Blackwall Railway. The small size and soft nature of the wire used offered little resistance to exterior friction, and when employed as incline or running ropes they soon flattened and wore out. The irregularity with which the wires were "formed" or twisted into strands, frequently crossing and recrossing one another, and the great difference in the length of the wires as well as the short "lay" of

FIG. 5.



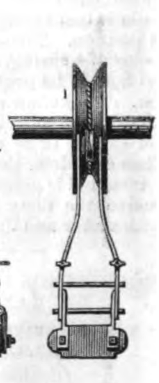
Machine for Laying Hemp Strands into Rope.

FIG. 6.



Side elevation of Spool Frame.

FIG. 7.



Tightening Pulley.

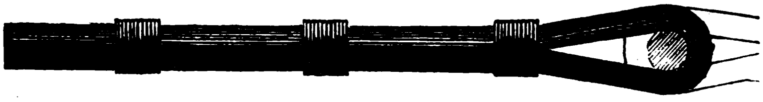
the ropes, amounting to only 4½ in. pitch, materially assisted to destroy them. Even when used simply as standing rigging, the wires frequently broke, and the broken ends stuck outwards to the danger of the sailors handling the rigging; and to prevent accidents they were served with yarn, like the "selvagee" rope, after having been "wormed;" that is, having a yarn laid in between each strand so as to alter the shape to a round form.

The "formed" wire ropes were originally made on the rope ground by the forming machine usually employed in hemp rope making. The wires were wound on bobbins placed in racks, just like the hemp yarns, and were led through the perforated register plate, called the "minor" plate, thence through the taper steel nipper or compressing tube, and were attached to the forming machine, which drew out the wires and twisted them together as it travelled backwards towards the other end of the ground. Having arrived there the machine was stopped, and the length of strand thus made was wound upon a large reel, ready to be placed in the laying machine; the use of the reel also enabled a longer length of strand to be made than one length of the ground. For laying the strands into rope, the required number of reels of strand, generally four, were placed in frames mounted on horizontal bearings and geared together. The strands were stretched along the rope ground, being supported and separated on trestles placed at intervals; and were brought together over a "laying top" at the other end of the ground, and attached to a revolving hook. Motion was given to the machine at one end with the four strand reels, and to the hook at the other end in the opposite direction, by means of a "fly-rope" or endless driving rope, passing over whelp wheels attached to the machine and the hook; the laying top was carried by a workman, who thus regulated the amount of lay or twist. Afterwards the laying top was mounted on a carriage which travelled on rails, and was drawn forwards by another endless rope, called the "ground" rope, which was worked by the machine. This arrangement had the effect of more effectually regulating the lay. "Formed" wire rope is now made in the ordinary vertical machine, which is supplied with extra frames for carrying a large number of bobbins; but for forming the strands the bobbin frames are fixed to the frame of the machine, and not revolving in it, and the wires are brought together through a perforated plate containing the required number of holes.

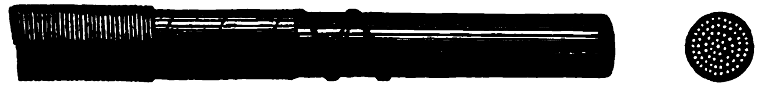
"Formed" wire ropes were at first well saturated with the solution before described; but afterwards galvanised wire was used for making them. The Admiralty still continue to use the "formed" rope entirely, though little is now used elsewhere. "Formed" ropes made of copper wire were used largely in the navy as lightning conductors, the size of the wire being about No. 20 wire-gauge or 0·036 in. diameter, and the rope was made of four strands laid round a small copper wire core. Smaller ropes composed of iron and copper wire were also used as sash lines, &c.

In another kind of wire rope, which was sometimes made on the machinery above described for the manufacture of "formed" rope, the strands were composed of hard wires, usually not exceeding six in number, laid around a core of hemp or wire; and these strands were again laid around a hemp core into a rope. But the objections caused by the rigidity of these ropes prevented any but small sizes being used for some years. Ultimately, however, these objections were overcome, and this construction has now almost entirely superseded the "formed" rope.

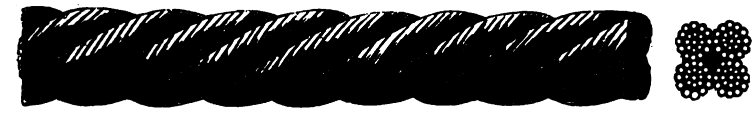
The first flat wire ropes, made twenty-six years ago, were composed of from eight to twelve "formed" strands, with the twist alternately right and left handed, made of a number of fine wires usually about 18 or 20 wire-gauge or 0·050 to 0·036 in. diameter. These strands were placed in the position of the warp, in a loom of the ordinary form, but greater strength, and were



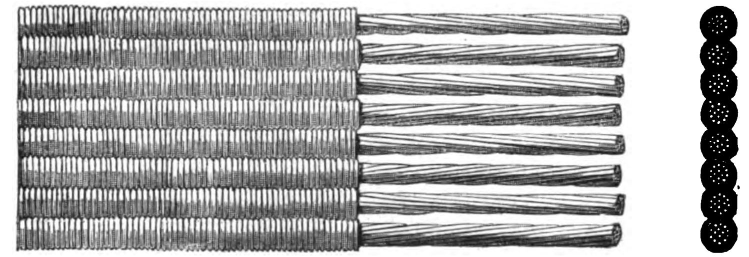
Frieburg Suspension Bridge Cable.—1835.



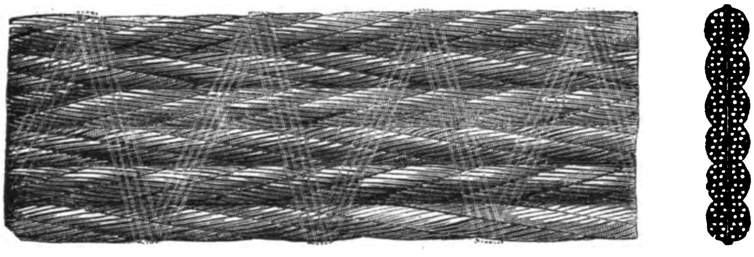
" Selvagee " Wire Rope.—1835.



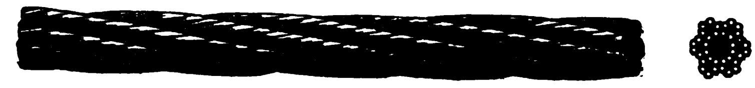
"Formed" Wire Rope.—1837.



First Flat Wire Rope.—1836.

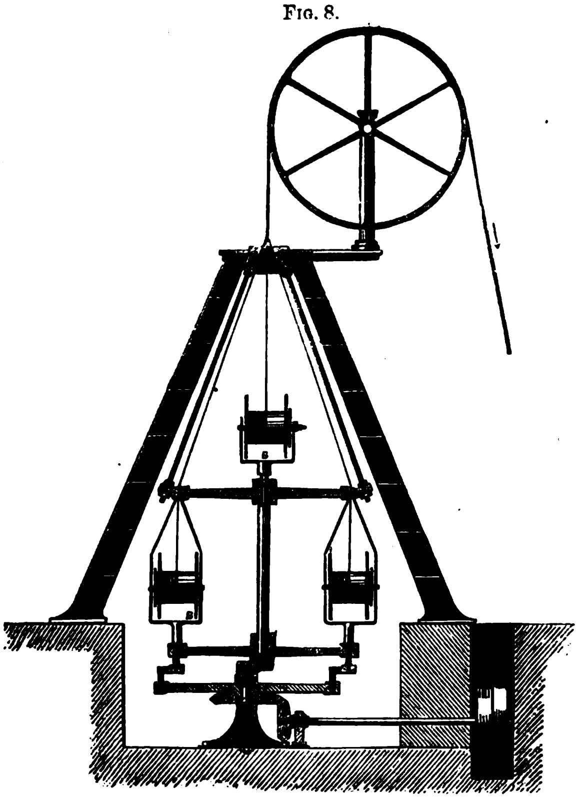


Second Flat Wire Rope.—1837.



"Laid" Wire Rope.—1838.

FIG. 8.



Huddart's Wire Rope Machine.

woven together with a shoot of strong yarn. Very little twist was put into the strands, as the yarn when woven in kept them in form. These ropes were by no means durable, as the yarn soon wore out, especially at the edges; and their application was very limited.

Flat wire ropes were next made, about 25 years ago, of four or six "formed" ropes, each made of four strands "laid" very long, and alternately right and left handed; these were stretched together side by side and sewn through with six wires of No. 14 or 16 wire-gauge from side to side in a zigzag direction, as shown. This was accomplished by carefully inserting a needle of dagger shape between the strands of the ropes, and so making a passage for the wires, which were carefully laid side by side. The round ropes thus bound together resembled the ordinary flat rope in appearance. The process was tedious, on account of the care necessary to avoid penetrating the strands with the needle, which would do great injury to the rope. It was also important that the amount of "lay" or twist in all the ropes composing the flat rope should be exactly the same, otherwise the stretching could not be regular, and some of the strands were liable to be cut when the rope was set to work. With the machinery previously described perfect regularity could not be attained in this respect, and an unsatisfactory result was the consequence.

The next and last construction of wire rope, introduced about 24 years ago, is known as "laid" rope, in which the strands were made of a few wires, seldom exceeding six, "laid" around a core of hemp or wire, the wires of the strand being entirely free from twist, each wire being simply "laid" in a spiral form without any twist in the wire itself. Six of these strands were again "laid" without "forehard" or additional twist into a rope, around a core generally of hemp. The size of wire usually varied with the size of the rope, as the total number of wires, 36, was seldom varied. The wire was hard or unannealed; and by the system adopted in making a uniform length was obtained with entire absence of twist. By this means, the full strength of the wire was retained, and, consequently, the rope produced was much stronger for the same weight. An increase in size is, however, caused by the introduction of the hemp cores, which amount to one-seventh of the entire bulk in the case of ropes with six strands of six wires each, the construction now usually adopted.

These "laid" wire ropes, though not so pliable or strong as "formed" ropes, possess many advantages, especially when employed as incline ropes, the hardness and increased size of the wire giving greatly increased durability; and as the prejudice against wire ropes had been partially removed by the introduction of the "formed" ropes, the present "laid" ropes soon began to be extensively used; and within the last few years, since the expiration of many patents formerly existing, the manufacture has increased to a remarkable extent. Wire strand has lately come into extensive use for fencing, very large quantities being exported for that purpose for the Indian railways.

Flat wire ropes also are now made with strands composed of hard wires "laid" together, instead of "formed" as previously, these strands being again "laid" into ropes without any "forehard" or additional twist, and the ropes are then stitched together as previously described. Lately, instead of several wires laid side by side being used for stitching, three or four strands have been substituted, each strand containing three wires laid together; the advantage of which is, that though several of the single wires may be worn through, the strand still holds the rope together: yet in neatness of appearance the single wires have the preference.

The machinery used in the manufacture of "laid" strands and ropes originally consisted of the ordinary machinery used on rope grounds for laying or closing hemp ropes, the machines at each end of the factory being speeded alike, as previously described.

The next form of machine adopted had simply one hook, mounted in bearings on a fixed frame, and driven by hand or power, to which all the wires composing the strands were attached; these were stretched along the ground, supported at intervals on trestles, till they reached the other end, where they were hooked on to swivels or "lopers." Attached to the lopers were cords passing over pulleys, and having weights suspended from them so as to regulate the tension of each wire and also allow for the shrinkage of the rope in the process of making. When the hook was set in motion, the twist in each wire traversed the entire length of the wire, and escaped at the end by means of the "loper" or swivel. A perforated plate or "laying-top" was used, carried by a workman along the ground, regulating the amount of "lay" or twist.

The next machine used, shown in Fig. 8, was a modification of Huddart's hemp rope laying machine, previously described and shown in Fig. 5. In these machines the operation went on continuously until the required length of strand or rope was made, giving rise to the name of "endless" machines; they were also called "vertical" machines, because the main frame carrying the spools revolves on a vertical axis. The first modification of this machine for making wire ropes consisted in altering the gearing for working the spool frames B, so that no additional twist or "forehard" was put in the wires as in the strands of hemp ropes, the pinions on the spool frames being now made of exactly the same diameter as the central dead wheel, causing the spool frames to make exactly one rotation on their axes for each revolution of the machine. Machines of this description were also made to work on a horizontal axis instead of a vertical one; and a balance weight was sometimes attached to each spool frame in the horizontal machines, which by its gravity prevented the spool from twisting the wire and rendered gearing unnecessary for the purpose; but the speed of these machines was limited in consequence.

The next form of machine was that known as a "compound" machine, for producing the entire rope finished at one operation; and may be described as consisting of six stranding machines, like that last described, all mounted on one large frame and revolving horizontally, the necessary motion being given to the machinery to lay the wires into strands, and then the strands into rope, without producing any twist in the individual wires. This machine, though a mechanical success, was a commercial failure, and was soon abandoned for the simpler and cheaper plan of first making the strands and then laying them into ropes on separate machines.

Next some modification was made in the vertical machines, shown in Fig. 8, in the means of preventing twist of the wires during the laying, by employing a centre crank or eccentric and four outer cranks on the spool frames B, as shown in Fig. 8; and also by substituting chain wheels and pitch chain. Machines were constructed with 36 spools on the revolving frame, connected by cranks to the centre crank; and ropes were thus made with that or any smaller number of untwisted wires in each strand; but this description of rope was rarely used.

In all the vertical and horizontal endless machines that have now been described, all the spools were mounted in one set on a single large revolving table, thus revolving all in one plane; and during the process of laying, the whole weight of the material had to be carried round a circular track varying with the size of the machine from 10 to 40 ft., one revolution being necessary for every lay put into the strand or rope, the lay varying from 1 in. to 18 in. or more, in pitch, according to the size of rope. Machines of this construction were therefore necessarily limited in their speed. Lately, however, machines have been constructed with the spools arranged in two sets of three each, on two tables one below or behind the other, the spools thus revolving in two planes; whereby a somewhat increased speed was attained, as the diameter of the revolving tables was reduced. Yet still the spool frames had to be carried round the common centre, and caused to rotate on their own centres once for every lay.

The method of joining the lengths of wires was, in the first instance, by twisting the ends together; afterwards, in the manufacture of "laid" strands, by "tucking," that is, cutting out the hemp core about 12 in. from the end of the wire that has run out, and inserting in its place the end of the new length of wire; the rest of the wires are then "laid" up on the new wire as a core for a length of 6 in., when the new wire is brought out into its right place, and the remaining 6 in. of the old wire passed in as the core, on which the laying is again continued till the end of the wire is reached; the proper hemp core is then replaced, and the process of laying resumed as before. Some manufacturers prefer to braze or weld the ends of the wires together for joining the lengths; wire as small as No. 16 wire gauge or 0·065 in diameter being welded by experienced workmen by means of a common portable forge.

An improved construction of wire rope machine has subsequently been introduced by Mr. A. Smith, of London, in which the bobbin frames and bobbins are placed one behind another all in the axis of the revolving frame, and remain stationary in that position, while the frame alone is made to revolve. By this machine a greatly increased speed is attained, and it is considered that better work is produced. The rate of production is also much increased; as much as 10,000 yards of strand having been made per day of ten hours, instead of only 2,500 yards, the usual amount made by the ordinary form of machine.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

At the ordinary meeting, Feb. 10, 1863 (E. W. Binney, F.R.S., F.G.S., in the chair), Mr. Dyer read a paper entitled "Notes on the Introduction of Steam Navigation."

Mr. Dyer stated that this subject, being of great importance, had engaged many able pens in tracing the origin of the several inventions and experiments that preceded the final triumph of steam power over that of wind for navigating ships; each writer claiming the honour of priority for his own country. It may be useful to state the order in which and the parties by whom the principal attempts were made to realise that object. Several letters lately appeared in the *Times*, and were thence transferred to the pages of the *Engineer*, giving a graphic account of the "first steamer in English waters," the "'Margery,' built at Dumbarton, by the late William Denny, for William Anderson, of Glasgow, and passed through the canal to the Forth, and thence to the Thames, where she arrived on the 23rd of January, 1815." On the authority of Mr. Anderson, then, this date is fixed when the first steam-boat was seen on English waters. The first steam-boat, the "Claremont," was started as a regular packet on the Hudson River in the spring of 1807; so that the first steamer seen on the American waters was fifty-five years ago, a lapse of time that should now insure a calm view of the steps that led to this first actual success in steam navigation. It will be shown that, by a long course of persevering labour, the honours of that success must be conceded to Robert Fulton, by whom it was achieved.

Whilst admitting the merits of other ingenious men long engaged in the same pursuit, it is clearly proved that, either from good fortune, or by the exercise of superior judgment and skill the race was won by eight years' priority of steam navigation, by Fulton, on the Hudson river.

In 1793, Mr. Fulton sent his plan for a steam-boat to Lord Stanhope, who approved of, and thanked him for the communication. Shortly after, Fulton went to Paris, and made experiments on the French waters, with the chain floats, the duck's-foot paddles, the screw or smoke-jack propellers, and with paddle wheels, to which latter he gave the preference, and constructed a boat with them in 1803, which was the model adopted in building the "Claremont," in 1806.

Mr. Dyer had sailed in the "Claremont," and remembers the sensation created by her appearance, and the high admiration bestowed on the author of so great an enterprise. That sensation in 1807 was precisely the same as the "Margery" created among the vessels on the Thames in 1815.

All attempts at steam navigation were fruitless before the invention of Mr. Watt's steam-engine, his engine being the first that could be usefully applied to rotative machines on land, and therefore for propelling ships. The principal claims put forth by other inventors of steam-boats are the following:—

In France, the Marquis de Jauffroy constructed a steam-boat at Lyons, in 1782, "with paddle wheels," but that this boat did not succeed is obvious, because she was not heard of until 1816, when the first Fulton boat was started to run on the Seine.

In 1783, Daniel Bernoulli proposed a plan which consisted of forcing water through a tube, out at the stern of the boat. This scheme has been tried many times since, but fails on account of the defective principle of applying the force. Endless chains, with float propellers, have been many times tried, and have failed on the same ground.

In 1795, Lord Stanhope made experiments with a boat on the Thames, using the reciprocating or "duck's-foot" paddles, which also failed, from the loss of time and power by the return stroke.

In 178[illegible], James Rumsey, of Virginia, tried a boat on the Potomac, and afterwards in London, both without success; and about the same time Mr. Fitch, of Philadelphia, tried one with paddle wheels, on the Delaware, but this boat also did not succeed and was given up as a failure. J. C. Stephens, of New York, made experiments in 180[illegible], with a "boat 25 ft. long and 5 ft. wide," which of course did no good, and was [illegible] a failure, though again brought to notice as preceding Mr. Fulton's

In 1788 and 1789, William Symington, in conjunction with Patrick Millar and James Taylor, made experiments with their patents for navigating by steam, and in 1802 commenced running a boat on the canal at Glasgow which made three miles an hour, but after many changes of her propellers, and trials, the scheme was given up, and no more was heard of the steam-boat of Mr. Symington until long after those of Fulton were widely spread over the American waters.

In 1816, the Marquis de Jauffroy complained that the Fulton steam-boat on the Seine had taken the "paddle-wheels" invented by him and used at Lyons thirty-four years before, but also abandoned by him. To this charge Mons. Royou replied in the *Journal des Debats*, thus:—"It is not concerning an invention, but the means of applying a power already known. Fulton never pretended to be an inventor in regard to steam-boats in any other sense. The application of steam to navigation had been thought of by all artists, but the means of applying it were wanting, and Fulton furnished them."

The first ocean steamer was the "Fulton," of 327 tons, built in 1813, and the first steamer for harbour defence was built under Fulton's direction, 2,740 tons, launched in 1814. This became the model ship for the iron clad batteries and rams, since constructed with many changes. It will be seen by the drawings of Fulton's plans, that he had tried the several other kinds of propellers—the chain float, duck's-foot, and the screw fan—before adopting the paddle wheel, for though the screw was good in principle, it was many years before it could be constructed to act efficiently. The "James Watt" was the first boat with the screw running between London and Havre, about ten years after the advent of the "Margery."

In 1811 I endeavoured to introduce steam navigation into England, but I found a strong conviction that it would not answer in this country, our most eminent engineers saying, "We don't doubt the success of steam-boats in the wide rivers and harbours of America, but in our comparatively small rivers and crowded harbours they will never answer." Even such scientific engineers as the late John Rennie, sen., and Peter Ewart, a vice-president of this society, both advised me to relinquish the attempt to introduce steam-boats, as sure to prove a waste of time and money to no purpose. However, when conviction came over the public mind that steam navigation would answer here—but not until after more than 5,000 tons of steam-boats had been launched on the Hudson in 1816, did it so come—then began the spread of steam navigation, since extended with such marvellous rapidity and perfection as to atone for the sluggish beginning. Since nations are indebted to the genius of Watt for success in using steam power, to that of Fulton for its successful application to navigation, to Stephenson for the like success on railways, the meed of praise due to each of their names should be cheerfully awarded by all who are so largely benefited by the result of their labours. In doing this we should bear in mind, that inventions do not spring into existence perfect from their birth, like Pallas from the brain of Jupiter, but they come from the prior labours of many brains, and he is the true inventor who first collects the essence of and gives the stamp of vitality to those labours. In this sense the invention of steam navigation will for ever illustrate the name of Robert Fulton.

NORTH OF ENGLAND INSTITUTE OF MINING ENGINEERS.

The usual monthly meeting was held on Thursday, Feb. 5, in the rooms of the institute, Neville Hall, Newcastle-upon-Tyne; Nicholas Wood, Esq., president, in the chair.

After some other business, a paper on "Messrs. Donnisthorpe, Frith, and Hedley's coal-cutting machine, by Messrs. J. Daglish and L. Wood," was then read by Mr. Wood:—

ABSTRACT OF PAPER ON DONNISTHORP, FRITH, AND HEDLEY'S COAL-CUTTING MACHINE.

This machine, which is in successful operation, consists of an 8-inch cylinder, mounted on a frame fitted up with the ordinary tram wheels, moving along a tramway parallel to the face of the coal; the piston works a quadrant on a vertical shaft, and on the same shaft is attached a large coal pick, which by this means works in a horizontal plane, in a very similar manner to when used by the miner. The motive power used for working the machine is compressed air, which, at the West Ardsley Mine is obtained from a large receiver on the surface, into which it is pumped by a 30-horse power engine; it is conveyed from this receiver down the shaft in 4-inch metal pipes, and by 2½-inch pipes from that point to any part of the mine where it is required. The air is compressed to 55 lbs. per square-inch. Apart from any commercial considerations, there can be no doubt that a very considerable saving in the produce of large coal will be effected by the introduction of efficient machinery; and taking into consideration the great increase of consumption, and the already approaching scarcity of coal in some of the coal districts, the question becomes one of really national importance. The use of compressed air machines will also, in several ways, be of considerable advantage to the working miner; not only will it aid the working miner; not only will it aid the ventilation; but it will supply a current of air at a very low temperature, due to its sudden expansion, which will afford great physical relief in deep mines when the temperature is considerably elevated; further, the pipes, if carefully laid, would always be ready, in cases of explosion, to permit a current of pure air to be forced into those districts into which the atmosphere might be vitiated by the combustion of the gases. These machines will also relieve the miner of much of the more arduous, painful, and monotonous portions of his toil, especially in low and hard seams.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

To insure insertion in the following number, advertisments should reach the office not later than 5 o'clock on Thursday evening.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of his good faith.

J. B.—N. B.—J. E. D.—J. W. R.—A. and P.—J. A. D.-J. O.—T. G.—G. R.—Capt. C. P. L.—J. N.—E. B.—J. P.

W. R.—Too full of personal matters. The letter is more fitted for our advertising columns.

Hoist.—We believe that there are about 3,000 collieries in England. They raise 80,000,000 tons of coal, probably worth at the pit's mouth, about £25,000,000.

S. B. Schiele's noiseless fan is arranged upon the same *general* principle as Lloyds; but it is carried out in a different manner.

E. P.—You should write to the Under Secretary of State for India, India Office, Victoria-street, Westminster.

Protection.—You are not allowed to make for your own use, without a license, anything covered by a patent or protected under the Registration of Designs Act.

A Boiler Maker.—We should object to the use of any chemicals for preventing incrustation in a steam boiler. Carbonate of soda is, however, recommended by Mr. Fletcher, of the Manchester Boiler Assurance Company, as will be seen in his report given in the present Number.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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SUBMARINE TELEGRAPHY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Whether a writer in your paper announces his name or writes anonymously, I apprehend that as long as he writes common sense, and his arguments on his subject are sound, it little matters to your readers, and I (for the simple reason furnished you), must still ask to remain what, in truth, I am, "An Old Sailor;" but, if Dr. Wallich considered my observations worth answering at all, he should have replied with temper (good I mean), and if his schemes are sound he should tenaciously keep to the point of the objections raised to them.

In stating mine to Dr. Wallich's sounding scheme, I mentioned the authority from which I derived my information, and which I believe to be substantially correct, so if your readers will take the trouble to compare my letter and the authority on which I based it, they will be able to judge if, "under the cover of an *incognito*, I have resorted to misinterpretations." Again, I assert that both the doctor's schemes are simply impracticable, the one as much so as the other. An illustration may be useful to prove it; and I will take well-known islands and rocks for my purpose, which have been visited many times by scientific officers with the best instruments. St. Paul's on the line, its position by the best authorities differ no less than 10 miles; Fernando Nevonhee, 8 miles; Trinidad, 10 miles. Now, if there is so much difference in results by different observers using an artificial horizon, and having all the advantage of shore observation, can Dr. Wallich assert that his *belt* can be kept, or that his submarine buoys would ever be found again, even allowing that they can be placed in position, which I deny; and yet I grant that the lines of soundings heretofore laid down in the charts to be "perfectly trustworthy, and not falsified records;" and every sailor will understand the nature of my belief, viz., that the position of each sounding is as correctly placed on the chart as it is possible to do by means of observations of all kinds at sea; and were you to ask any seaman how nearly that could be ascertained, he would probably answer, "within a few miles under ordinary circumstances."

If Dr. Wallich will take a chart on a large scale, draw the arc of a great circle across the ocean on the line Capt. Dayman was supposed to run, then with the positions recorded carefully prick them off on the chart, he will at once see that the line he proposes as the basis of his own was never run at all, and that almost every sounding will be to the right or left of the line.

But granting the line of soundings obtained, the doctor has not explained how he is going to run the cable over it, nor how he is going to moor his buoys to hold the line that is to be fast to the cable. (The doctor did not detect my error in stating that each of his buoys would have to support 4 miles of moving cable; on referring to his plan I see they would have to support 8 *miles!*")

I may propose to make a voyage to the moon, but if I did not explain the means by which I was to get there, I do not think my proposal would be dignified by being called a "scheme."

I am truly glad to hear that the doctor intends to tender his thanks for services rendered during his late cruize—tardy though they be. I have taken in many works in parts, but I have yet to learn that the latter part is "the only portion of the work in which a preface could be inserted."

Lastly, the doctor says, "to any knowledge of seamanship I have not pretended," yet in the last clause of his paper, addressed to the President and Council of the Royal Geographical Society, he says, "It rests with those who are competent to form an opinion on the subject, to determine whether or not my proposals deserve serious consideration; and also whether I am personally qualified to undertake the various researches indicated. Should I be recommended for the duty for which I have endeavoured to fit myself, I can only say my best efforts shall be put in force to do that duty well."

Whether any of those competent to form an opinion on the subject have considered the doctor's proposals deserve serious consideration, I know not; but all I have spoken to on the subject say they are not, and Dr. Wallich had better confess with a good grace that he has made a mistake.

Anxious as I and many are to see the bed of the ocean systematically examined, it must be by some other scheme than Dr. Wallich's, and I cannot think his exposition has done good to the cause.

As to being ridiculous, &c., the question simply is this:—Can either of Dr. Wallich's schemes be carried out? I say they cannot. Dr. Wallich says they can. One must be wrong; and that one is he, who has held himself up to ridicule, conferred trouble on the other, and occupied your space in vain.

I thank the doctor for his wish; the gout is better, but I laid no claim to the "spleen"—I leave that with him, and remain

Yours, &c.,
An Old Sailor.

TO ACCLIMATISE COTTON.

Sir,—Whatever may be urged to the contrary, I feel convinced that if the following plan is pursued, that the cotton plant may be acclimatised. So late in the season as the 15th of last July, I sowed the seeds of the *several* varieties of cottons (presented me by the Cotton Supply Association of Manchester) together, and in five days they broke ground, and at the end of four weeks they attained five inches in the open air. But they were sown too late in the season. Ginger, tamarind, and Indian corn, sown in a hotbed (as under) and then transplanted in the open air, will attain a good height in one season, the last arriving at maturity, and why not cotton?

Directions.—Plant the several kinds of cotton seeds together in a hotbed about the middle of *March*, and when the plants appear water freely. Select the most vigorous plants, in the middle of *April*, and transplant into a *slighter* hotbed for *three* weeks longer to encourage their growth. Then select the most vigorous plants again for transplanting in the open air in properly manured ground. But, if grown as a tree in our hot-houses, during successive years, and each year *gradually* exposed to low temperatures, the tree will in an advanced stage of growth resist our severe climate. In the south and west of England, the myrtle flourishes, produces blossoms, and seeds, in consequence of this process, as an *unprotected* standard tree; and the layers from such trees are much more hardy than the layers from myrtles reared within doors. The disposition of trees may be changed thus gradually, and a new climate be made supportable.

The "arbutus" has, from the same cultivation, become the principal ornament of the lakes of the south of Ireland. It thrives even in the bleakest mountainous situations. I am, &c.,

James Bruce.

Meetings for the Week.

Mon.—*Royal Geographical Society*, 1, "On the Discharge of Water from the Interior of Greenland, through Springs underneath the Ice," by Dr. H. Rink, of Greenland. 2, "On Rupert Land," by Captain Millington H. Lynge, R.E., at 8.30 p.m.
British Architects, at 8 p.m.
Tues.—*Inst. Civil Engineers*, 1, "On American Timber Bridges," by Mr. J. R. Mosse. 2, "On the Reconstruction of the Dinting and Motham Viaducts," by W. Fairbairn, Esq., at 8 p.m.
Royal Inst., "On Animal Mechanics," by Prof. Marshall, at 3 p.m.
Wed.—*Soc. of Arts*, "On the Best Means for Promoting the Supply of Cotton," by John Cheetham, Esq., at 8 p.m.
London Inst., "On the Zoology of Warm-blooded Vertebrata," by C. C. Blake, Esq., at 7 p.m.
Thur.—*Royal Inst.*, "On Chemical Affinity," by Dr. E. Frankland, at 3 p.m.
Antiquaries, at 8.30 p.m.
Royal Soc., at 8.30 p.m.
Fri.—*London Inst.*, "On the Chemistry of the Non-Metallic Elements," by F. Field, Esq., at 7 p.m.
Royal Inst., "On the Ancient Lake Habitations of Switzerland, at 8 p.m.
Architectural Assoc., Class of Design—Organ.
Sat.—*Royal Inst.*, "On the Science of Language," by Prof. Max Muller, at 3 p.m.

Since the substitution of steam fire-engines in Baltimore, the losses by fire have been reduced almost to *nil*. Last year the insurances ran up to 120,000,000 dols., while the absolute losses by fire do not exceed 15,000 dols., and this is in a city of at least 220,000 inhabitants.

Gossip.

A curious project has been set on foot by M. Faget, of Bordeaux, for the speedy conveyance of letters between England and France. He proposes to erect in both countries, at a distance of about 1,000 metres from the coasts of Calais and Dover, a strong edifice of masonry, containing a steam engine of sufficient power, by means of which an immense wheel, 25 metres in diameter, is made to turn 40 times a minute. By this rotation a series of wires, forming a gigantic strap extending across the Channel, is coiled round the wheel at one end—say Dover—and uncoiled at the other (Calais), and conversely. To this strap india-rubber letter-bags are attached, which are thus to be conveyed across the Channel at the rate of 3,000 metres per minute, so that, within the space of twelve minutes, the letters and despatches from one country may be landed in the other. The length alone of the strap is sufficient to cause its submersion, and the transmission might be effected in any weather.

The half-yearly report of the directors of the District Telegraph Company has been issued. It shows a net increase in the receipts of £1,406 7s. 4d., as compared with the corresponding period in 1861, and it is mentioned that the annual income of the company continues steadily to progress. A few additional contracts for private telegraphs have been undertaken where desirable, and amongst others telegraphs have been provided between some of the stations of the London Fire Brigade.

A bill has just been brought before Parliament to make general regulations in respect to all telegraph companies, existing and future, but not to affect existing companies in respect of a past exercise of powers. Much of the bill is of general interest and concern. No telegraph above ground is to be placed within ten yards of a dwelling house worth £20 a-year, or across an avenue or approach to such a house, without the consent of the occupier of the house. But a subsequent clause provides, that where the body having the control of a street consents to a telegraph being placed along it, that consent is to be sufficient authority for placing he telegraph along or over any land or building "adjoining to or near the street," but not directly over any building if the owner or occupier objects. Any person in the employment of a telegraph company wilfully or negligently delaying a message, or improperly divulging its purport, is to be liable to a penalty not exceeding £20. Every telegraph is to be open to all persons without favour or precedence, except that messages on her Majesty's service are to have precedence, if required by any department of the Government. Telegraphs also may be taken possession of for her Majesty's service, if the Secretary of State is of opinion that an emergency has arisen in which it is expedient for the public service that the Government should have control over the transmission of messages; the company to be compensated according to the average profits of the previous three months.

A Belgian glass-blower has lately blown two large bottles, each of a capacity of 62½ gallons, and weighing 50 pounds. They were blown at the glass-works of Lefevre and Co., at Lodelingart, and are nearly double the size of the largest bottles heretofore made.

A recent writer in the Toronto *Globe* says:—The question most eagerly asked of persons just come from Enniskillen, is generally the all-important one of whether the wells are holding out or not. It is a fact that many of the flowing wells have ceased to flow; and others, while still continuing to flow, do no longer yield the immense quantities that they did at first. But then, there remains yet untouched a large area of what there is every reason to believe to be good productive oil territory. The work of drilling and sinking wells is still vigourously carried on, and a rise in the price of crude oil to 1 or 2 dols. per barrel would set the drills going at a rate hitherto unheard of. The owners of wells which have ceased to flow do not think it worth while to drill down any further until a more remunerative demand arises for crude oil. When this takes place, every effort will be made, both by drilling further and pumping, to bring the oil up, if there is any to bring. The question whether former flowing wells will yield oil by pumping has yet to be determined. Oil Springs is certainly the busiest place of its size to be seen; in fact, a perfect hive of industry, full of life and motion. The population of the whole diggings is estimated at 2,000 or more. There are still more people than can find house-room to live in, and rents are of tiptop height. Landlords of houses appear to have taken "Excelsior" for their motto. Think of 6 dols. a month for the upstairs, merely, of a frame house about 18 by 24, and three or four competitors for that. People continue to come in faster than houses can be built for them. The hotels and boarding houses are crowded, and the unfortunate inmates are fairly lost for want of a place to go to in the evening, and even for seats to sit upon after supper time.

At a recent meeting of the Manchester Literary and Philosophical Society, Dr. Joule described a barometer for measuring small atmospheric disturbances. It consists of a large carboy connected by a glass tube, with a miniature gasometer formed by inverting a small platinum crucible over a small vessel of water. The crucible is attached to the short end of a finely suspended lever, multiplying its motion six times. When the apparatus was raised two feet, the index moved through one inch; hence he was able, in serene weather, to observe the effect corresponding to the elevation of less than one inch. The barometer is placed in a building, the slated roof of which affords, without perceptible draught, free communication with the external atmosphere. In this situation it was found that the slightest wind caused the index to oscillate, a gale occasioning oscillations of two inches, an increase of pressure being generally observed when the gusts took place.

Mr. Joseph Sidebotham exhibited, at a recent meeting of the Manchester Philosopical Society, a cornelian pebble with a cavity containing a globule of water, brought from the coast of Tuscany. These pebbles are often picked up on the shore, and when broken exhibit a crystalline cavity about one-third filled with water.

Steel for Fire-arms.—Captain Caron has been for some time addressing papers to the Academy of Sciences about his experiments on steel, effected at the Depot des Poudres et Saltpètres, for the purpose of applying that metal to ordnance and fire-arms in general. More than twelve months ago, samples of a peculiar soft steel were brought to the artillery factories, and the remarkable qualities of this metal induced Colonel Trielle de Beaulieu, the director, to apply it to the manufacture of tubes intended to protect the copper of the points of sight of heavy ordnance. This steel has the property of drawing cold, in tubes of any dimensions, and after drawing—above all, if the metal be tempered—the grain, perfectly homogeneous, is fine and watered, the steel has become strengthened (*nerveuc*), and offers an extraordinary amount of resistance. Since then gun-barrels, manufactured from the same material, have been presented to the factory for the models of arms, and Captain Maldin, director of this establishment, struck by the beauty of the metal, thought it his duty to try the barrels, in order to establish their quality. The following are the very curious results at which this officer has arrived:—A gun-barrel of the ordinary dimensions of that of a sporting gun, after having been trued, was tried first with 30 grammes (1 oz.) of powder, and one ball of 37 grammes (1¼ oz.) This charge producing no deterioration was followed by trials with a ball of the same size, and in increasing the charge by 10 grammes at a time up to 60 grammes (2 oz.). The 60 grammes were then replaced by 40 grammes of extra fine Esquerdes powder (the most destructive powder known). Not being able to burst the barrel, the experiments were continued with gunpowder, and after some trials, a charge of 150 grammes (5 oz.) was arrived at without inducing a rupture. A last experiment was then tried, in which 150 grammes (5 oz.) of powder and five balls were employed, the latter weighing together 135 grammes (say 4¼ oz.) well rammed home. The only injury seen was a swelling in the barrel at the spot where each of the balls was placed, but the barrel was not burst, not even cracked. If it be considered that the charge of powder was already 23 in. long, and that a more considerable quantity would not have had time to burn entirely, it may be fearlessly concluded from these experiments that the metal employed in the manufacture of these barrels is capable of giving arms which cannot be burst by the effort of any charge of powder whatever.—*Galignani.*

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2094, 2095, 2110, 2117.
Boilers and Furnaces, 2103.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2109, 2119.
Ships and Boats, including their fittings, 2083, 2115, 2116.
Cultivation of the Soil, including agricultural implements and machines, 2082, 2097.
Food and Beverages, including apparatus for preparing food for men and animals, 2112.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2078, 2081, 2085, 2091, 2098, 2104, 2111.
Buildings and Building Materials, 2099, 2105.
Lighting, Heating, and Ventilating, 2096.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2080, 2092, 2114, 2118, 2120.
Metals, including apparatus for their manufacture, 2100, 2101.
Chemistry and Photography—*none.*
Electrical Apparatus—*none.*
Warfare, 2079, 2102.
Letter-Press Printing, 2017.
Miscellaneous, 2084, 2086, 2087, 2088, 2089, 2090, 2093, 2106, 2108, 2113, 2121.

2078. S. Lord and J. Lord. *Improvements in carding engines.* Dated July 22, 1862.

This invention consists, first, in improved modes of stopping the motion of the doffing cylinder, and feeding rollers, when a sliver is broken at any part, and does not enter the can or coiler. From the shaft which drives the can or coiler, the patentees give motion by a worm and wheel, spur, or bevel gearing, to a catch box on the upright of the coiler, thereby dispensing with wheels. The loose part of the catch box is forced out when the sliver breaks, or cannot enter the can or coiler by causing it to be held by a rod connected to the trumpet or balance lever. As the loose part of the catch box is moved out, it operates upon an incline or cam at one end of a double lever, the other end of which releases a catch and allows the barrow handle to be lowered, and bring the pinion out of gear and stop the engine whenever there is a breakage or defect in the sliver, without in any degree depending upon its tension. Secondly, in an improved mode of working the doffing knife or comb. They form in the doffing stock which holds the knife or comb a hole from end to end, through which hole they pass a shaft, having fixed to it two or more eccentrics which fit the hole, so that, when the shaft and excentrics revolve, an excentric movement is given to the knife or comb, which thereby strips the cylinder in a very efficient manner without injuring the card. *Patent completed.*

2079. P. F. Cassegrain. *Improvements in firearms.* Dated July 22, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2080. A. Fournier. *An improvement in the manufacture of easy chairs, railway and carriage seats, seats of any kind, and mattresses.* Dated July 22, 1862.

In carrying out this invention, the inventor places (instead of the ordinary webbing) bands of vulcanised india-rubber across the frame of the chair, or other seat or mattress, vertically and horizontally, interlacing them, and refixing them to the framework, making by this means an elastic foundation, after which the chair or other seat or mattress is stuffed in the ordinary manner; and in this way he also constructs the backs of chairs where they are stuffed or padded. *Patent completed.*

2081. D. W. Smith. *Certain improvements in power looms for weaving.* Dated July 22, 1862.

This invention relates to that portion of the loom known as the yarn beam, and consists in the novel application thereto of a break in the form of a circular hinged band, having a projecting piece attached. The hinged circular band may be made of metal, or other convenient material, and encircles the neck of the yarn beam, the friction thereupon being obtained and regulated by a screw passing through the ends of the band, and thus the revolution of the yarn beam is governed in a more simple manner than by means of the ropes and weight as hitherto. The projecting or tail-piece of the break bears against a stud or spring to prevent the break turning with the beam. *Patent abandoned.*

2082. J. Daniels. *Certain improvements in artificial manure.* Dated July 22, 1862.

This invention consists in grinding raw or unboiled bones for the purpose of producing a manure more rapidly beneficial to the land than where the said bones are cut or rasped. When bones are ground, the manuring properties thereof are expressed and brought to the surface, and in such state are more readily mixed with the land; but when cut or rasped it requires a considerable time to impregnate the land with the manure. *Patent completed.*

2083. R. Grogan. *Increasing the speed of screw-propeller steam-vessels.* Dated July 22, 1862.

This invention consists of certain vanes, or blades, of a flat, spiral, or other suitable form, two or more of which are mounted upon or attached to shafts, cranks, or beams, and wholly or partially submerged at, or in, or partially with, the sides, bottom, or stern of the vessel, where the same, when fitted to the required mechanism, can be made to act as a paddle, or take the place of a screw-propeller. The propeller is two-bladed, and its general form is that of a segment of a disc, or a parallelogram, which is made to rotate transversely upon or about an axis which traverses the blade, or upon which the blade traverses longitudinally. In constructing the propeller, the ends of the blades may be made of a spiral form, and one or more of these blades may be fitted either entire or in sections, so as to form a screw, or paddle, with two, three, four, or more, propelling vanes; by preference, however, the patentee uses a simple two-bladed propeller, the two vanes of which are in the same plane, or in planes at right angles, or inclined to each other. When the two vanes, or blades, are not in the same plane with each other, they are mounted so as to turn partially upon or about their respective longitudinal axis or axes, so that, as one paddle, or vane, enters the water flatways, the other vane leaves it edgeways, so as to enter and leave the water angularly, more or less, as circumstances may require. As these blades rotate about their transverse axes, they have a transversing motion longitudinally, in order to increase their stroke and dipping or propelling surface. *Patent completed.*

2084. W. E. Gedge. *An improved instrument for marking wadded or other stuffs.* (A communication.) Dated July 22, 1862.

This apparatus is composed of a cylinder, usually from 2in. to 4 in. long. On this cylinder is placed a disc, or discs. The ends of the cylinder carry a short spindle, to allow of its being secured in a frame, which tapers up to a handle. Grooved slides, either framed or not (but with means to retain them in parallel), are placed upon the stuff to be operated upon. The cylinder, and consequently the disc or discs, being heated, the operator takes the instrument by the handle aforesaid, and pushes it along the grooved slides, and the disc, or discs, mark out the squares upon the wadding, or stuff, which is to be placed upon a table, the surface of which may, with advantage, be slightly stuffed, or padded. By altering the position of the grooved slides, different sized square lines or lozenges may be impressed upon the stuffs. *Patent abandoned.*

2085. W. Crofts. *Improvements in the manufacture of fabrics by lace machinery, and in the means or apparatus employed therein.* Dated July 22, 1862.

The object of this invention is to produce various ornamental effects in fabrics by lace machinery. The inventor obtains a looped pile effect upon weaving, or opaque work, and between or upon pillars of fabric produced in twist lace machinery, by causing warped threads to be looped around holding out instruments, upon which such warp threads are wound whilst they are being tied into the fabric by other warp and bobbin threads. *Patent abandoned.*

2086. H. R. Summons. *An improved apparatus for bordering envelopes, paper, and cards.* Dated July 22, 1832.

This invention consists of an improved apparatus, by aid of which envelopes, paper, and cards, may be furnished with a bordered, black, or ornamental edge, with greater rapidity and regularity than by the means adopted for such purposes. The inventor proposes to fix on the surface of a bar of wood a metallic plate, the surface of which is provided with a series of indentations, or serrated edges, equidistant to each other. These serrated grooves are to be cut in an angular form—that is to say, they should form a right angle at or near the centre of the metallic plate, and the envelopes, paper, or cards, are to be placed or laid down on the metallic plate with their edges abutting against the edges of the steps, which the vertical faces of the indentations afford, and by means of which a numerous series of envelopes, cards, or paper, may be placed in such a position that their edges shall be respectively and equally paralled to each other. Or, in lieu of a plate, he proposes to lay and fix on the board a series of angular shaped slips or pieces, the edge of one overlapping the edge of the next, so as to form a series of serrated surfaces, similar to those presented by the serrated plate. In addition to the serrated edges he proposes, as an auxiliary to the aforesaid means of keeping the articles in position, to employ a series of narrow slips of cord, metal, or other material, fixed and inserted in the surface of each sloping groove, and underneath the next or high edge of the serrated groove, in such a manner that the edges of these slips shall just overlap the edges of the articles to be bordered as they are placed in the grooves, so as to hold them down, more securely during the process of arranging the series. Each side of the bar or board is furnished with a narrow hinged flap, which is opened during the foregoing process, but which is closed over the edges of the board on which the articles have been placed, so as to press upon their corners (and aided by thumb screws or other pressure) to hold them down while the process of bordering takes place, by means of brushes, as is ordinarily done. It will then be necessary to change the position of the envelopes, or other articles, in order to expose their opposite edges or borders to the action of the brush. He proposes to place under the edges of the articles, and on each side of the serrated plate previously to shutting, over the flaps, a slip of metal, in order to form a bearing surface for the flaps, and prevent the articles being pressed down on to the board itself, which would crease or damage the envelopes, cards, or paper. The serrated edges may be cut in any desired form, according to the shape of the article to be bordered; they may be set at any required angle, or on the square—that is to say, the grooves may be cut perpendicularly across the plate, or they may be cut in curvilinear grooves, and at any required distance apart, in order to suit any outline, and any width which it is desired to give to the margin of the envelope, paper, or card to be bordered. *Patent abandoned.*

2087. H. R. Summons. *Improvements in machinery or apparatus for bordering envelopes, paper, and cards.* Dated July 22, 1862.

In carrying out this invention, the inventor proposes to bolt or screw to a table, on standards, an iron bed plate, on which a raised block is fixed, having a smooth, flat surface, two sides or edges of which correspond with the shape of two edges of the envelope, paper, or card to be bordered. Underneath the table, and hinged to the standards, he arranges a treadle, from which extend vertically, through the bed plate, connecting rods, one of which is attached to a metal slide fitting against the two edges of the block, and raised a little above the surface thereof. This slide acts as a stop, and enables the envelope or other article to be bordered to be placed on the block by hand, exactly parallel with its edges. Another connecting rod passes through the opposite end of the bed-plate, and draws down an arm or lever of the second order attached to a hinged fulcrum between two pillars. The extremity of this lever is furnished with a thin, flexible steel plate, which is held above the block, and the edges of which plate, although parallel to the edges of the block, do not correspond therewith, but are so situated that, when pressed down upon an envelope or other article placed upon the block, they may leave two sides of the envelope, paper, or card exposed. The treadle being still further operated, the other connecting rod will draw down the sliding stop from the edges of the block, and the envelope or other article is then so exposed that it may be bordered by means of a brush. *Patent abandoned.*

2038. T. King. *Improvements in apparatus for measuring grain and other granular substances.* Dated July 22, 1862.

For the purposes of this invention a measurer is employed having two circular ends, the space between the two ends being divided radially by partitions, so as to produce angular measuring chambers around the central horizontal axis, and on which the measurer is caused to turn. The axis of the measurer turns in bearings carried by the framing of the machine, the upper portion above the axis being covered in by a bent plate or cover in the form of a semi-circular arch, which is fixed to the framing. There is an opening through such cover where the lower end of a hollow trunk or pipe is attached, which trunk or pipe descends from an upper floor, chamber, bin, or place from which the malt or grain or other granular substance descends through the trunk or pipe to the measurer. In the hollow trunk or pipe is a valve, the axis of which has a weighted lever fixed on it, and such lever is arranged to act on the driving strap (which communicates rotatory motion to the axis of the measurer) and causes such driving strap to be moved from the driving pulley on to the loose pulley, when the weight of the lever overcomes the valve by reason of the supply of malt or granular substance being insufficient, and the machine will thus be stopped; but so soon as the weight in the valve caused by an increased supply of the substance to be measured is sufficient to overcome the weighted lever, the driving strap will be again moved from the loose pulley to the fast one, and the machine be again put in motion. The driving pulley is on an axis on which there is a worm or screw, which gears with and drives a worm or screw wheel in the axis of the measurer. The malt, grain, or other granular substance is delivered from the measuring compartments as the radial partitions descend below the axis of the measurer. The measuring chambers or compartments are each capable of measuring a bushel or any other determined quantity of material. *Patent completed.*

2089. G. Payne. *Improvements in horse-shoes.* Dated July 22, 1862.

According to this invention, it is proposed to form a number of transverse grooves, channels, or indents, across the metal of the shoe, so as to leave alternate hollows and projections. The nail holes are made in the thicker or projecting portions and thus obtain a firm hold of the shoe. *Patent abandoned.*

2090. J. H. Johnson. *Improvements in the treatment or the noxious gases or vapours produced in the distillation or purification of tar.* (A communication.) Dated July 22, 1862.

This invention consists in causing such vapours to pass from the "etouffoir" or closed chamber, wherein the solid matters are deposited, into a second closed chamber, in place of allowing them to pass off direct into the atmosphere. The pipes which connect the first chamber with the second are inclined, so as so allow the napthaline and other products to pass freely into the second vessel with the vapours. A second pipe of considerable length connects the upper part of the second chamber with a furnace or fire-place, which effectually consumes the noxious vapours as fast as they enter the furnace, the harmless products of combustion passing off by a flue to a chimney. When the solid matter is withdrawn from the "etouffoir," it may be placed in a receptacle beneath a hood, which is also in communication with the furnace, so that the vapours arising therefrom may also be consumed in place of escaping direct into the atmosphere. *Patent abandoned.*

2091. A. C. Vautier. *Improvements in obtaining fibrous materials, and in manufacturing paper pulp, also in preparing, bleaching, and treating fibrous materials and fibrous and textile fabrics, and in producing agents used in part of the invention.* Dated July 22, 1852.

We cannot here give space to the details of this invention. *Patent completed.*

2092. J. J. Haley. *An improved machine for wringing clothing and other woven fabrics.* (A communuication.) Dated July 22, 1862.

This invention consists in the novel construction and arrangement of the various parts of a machine more especially designed for squeezing or forcing water from clothing and other fabrics, but which may be used without alteration for washing or expressing dirt from the same, and also to expedite the process of starching. These improvements relate to various methods of exerting the pressure upon the two rollers employed to properly adjust them to the thickness of the material or articles passed through the machine, to modes of fixing the machine firmly upon the tub or washing vessel, to a water-guide or slanting board for conducting the water back into the tub, and to a novel manner of attaching rolls of india-rubber, or other similar material, to shafts by which they are firmly secured, and chemical action, which takes place when the rolls come in contact with metal, is prevented. *Patent completed.*

2093. C. J. Keene. *A new or improved winding apparatus for raising and lowering canvas on easels.* Dated July 23, 1862.

This invention has, for its object, the adjusting with greater facility than has hitherto been done the position of the frame or rest board of easels on which the canvas is placed, and is constructed in the following manner:—To the back of the moveable frame is attached the working apparatus, consisting of a crown wheel through the centre of which a spindle is attached worked by a key or handle, and to which is geared a small toothed wheel attached to a worm or screw which lies within the circumference of the crown wheel, which worm or screw works in a rack screwed on the front of the central vertical piece. The turning of the key or handle causes the crown wheel, by means of the small toothed wheel, to work the worm or screw up and down the rack, and carries with it the frame and rest board upon which the canvas is placed. *Patent completed.*

2094. Z. Colburn. *Improvements in apparatus for the condensation of steam in steam-engines.* Dated July 23, 1852.

The air pump, as ordinarily used in condensing steam engines, performs two distinct purposes, the first of which is the removal, from the lower part of the condenser, of the condensed steam and injection water constantly collecting there, while the second purpose is the removal of air brought in with the injection water, and, to some extent, introduced through slight leaks in the condensing apparatus itself. Now the inventor dispenses with the air pump, and accomplishes its two purposes in the following manner:—Whenever he can obtain a clear fall of not less than 30 ft., or, which is better, 33 ft. below the lowest part of the condenser, he allows the injection water and condensed steam in the condenser to run off by their own gravity, and in opposition to the external pressure of the atmosphere, the overflow or discharge through which they descend having its lower or discharging end kept constantly under water, so that no air may enter it, and thus gain access to the condenser. This mode of keeping the condenser clear of water has been already occasionally employed by engineers, but not in a manner to dispense with the air pump. Where the inventor cannot obtain a clear fall of 30 ft. from the condenser, so as to discharge the water by its own gravity, and in opposition to the pressure of the external atmosphere, he then employs a force pump—which he prefers should be a centrifugal pump—to force out the water from the bottom of the condenser. The removal from the condenser of the air brought in with the injection water, and the air also introduced through leaks in the condensing apparatus itself, is as follows:—He employs for this purpose a vessel which he calls the hydraulic exhauster, and which vessel he places at a level somewhat above that of the condenser. The hydraulic exhauster is a vessel so fitted with valves that it may be first filled with water, and any air within the vessel will be thus expelled at the same time through a self-acting valve, after which the water in the exhauster may be emptied into the condenser, or into a vessel suspended within the condenser. The space which the water previously occupied in the exhauster will then receive a share of whatever air may be collected in the condenser, and in this manner the exhauster will perform the purpose of the ordinary air-pump in abstracting air from the condenser. The communication between the exhauster and condenser being then closed by a valve worked by the engine, and the exhauster being again filled with water and its contained air thereby expelled through a self-acting valve, it will repeat the operation previously described, and by being constantly worked in the manner hereinbefore explained, it will keep the condenser constantly free from air, except at the very low tension at which air is generally present in all good condensers. The water admitted to and discharged from the hydraulic exhauster in the manner described is afterwards used as injection water for condensing the steam in the condenser, this steam being the exhaust steam of the engine to which the apparatus herein described is applied. When the lower valve of the hydraulic exhauster is opened, and held open by means of mechanism worked by the engine, the water in the exhauster will fall through a pipe or other suitable passage into an open topped vessel suspended in the upper part of the condenser. From this vessel the water will flow out through a suitable injection nozzle or pipe, either fitted or not fitted with what is called a "rose," and thus the water will run into the lower part of the condenser, condensing the steam on its way. *Patent abandoned.*

2095. E. K. Dutton. *Certain improvements in steam engines.* Dated July 23, 1862.

This invention relates, principally, to that portion of the steam-engine generally known as the slide valve, and to apparatus connected therewith, and consists, first, in admitting the steam to the inside of the valve through a port in the valve face usually cast on the cylinder, the said port, by preference, corresponding in position to the ordinary exhaust port, the exhaust steam passing into the valve box. The valve may be of a similar form to that ordinarily used for "high pressure" engines, suitably furnished with a plate on the back, or other equivalent, to keep it to the face on the cylinder; or it may consist of a block or plate with a port through its centre sliding between an adjustable plate and the valve face constituting what is known as an equilibrium valve, the plate on the back of the valve sustaining the pressure of the steam. The second part of the invention is designed principally for the purpose of saving a portion of the steam usually lost in the passage between the ends of the cylinder and the valve; and the improvement consists in making the valve sufficiently long to discharge the steam into ports formed at or near each end of the cylinder, the steam being admitted to the centre of the valve from a port or ports in the valve face, and thence through passages, cast or formed in the valve, to the cylinder ports through openings or cross passages at each end of the valve, which said cross passages, together with the opening in the centre of the valve, are open through from front to back, and are closed at the back by a plate or plates between which and the valve face the valve slides. The said plate or plates are adjusted in distance from the valve face by means of screws or bolts, and nuts, springs being added to sustain the pressure of the steam, if preferred. The exhaust steam may either be allowed to pass into the valve box, or it may be conducted to openings in the valve face through passages formed in the valve, or partly in the valve and partly in the adjustable plate, in which case the valve box may be opened for the adjustment or inspection of the valve during the working of the engine. The third part of the invention consists in a novel method of cutting off the steam from the cylinder at any portion of the stroke when working expansively. *Patent abandoned.*

2096. A. Vignon. *Improvements in the means and apparatus for extinguishing fire, either on land or water.* (A communication.) Dated July 23, 1862.

The patentee claims,—1, The employment of a solution of carbonic acid gas, in water, either at a high or low pressure, for extinguishing fires on land or on board vessels. 2, The construction and employment of apparatus, either portable or fixed, for extinguishing fires, in which a solution of carbonic acid gas in water is prepared and stored up, and whence such solution is ejected with sufficient force without the aid of pumps. *Patent completed.*

2097. W. Clark. *Improvements in the manufacture of manure.* (A communication.) Dated July 23, 1862.

This invention relates to the manufacture of manure, termed "animalized lime," and consists in treating quick lime, which is slaked by sprinkling it with urine sewage water, or other fertilizing liquid, to which may be added pure water in certain proportions, according to the state of the lime and the matter to be treated. *Patent completed.*

2098. E. Alcan. *Improvements in machines for combing and carding wool and other filamentous materials.* (A communication.) Dated July 23, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2099. R. Bell. *Improvements in the manufacture of bricks.* (A communication.) Dated July 23, 1862.

This invention consists in certain improvements in the manufacture of bricks, by means of which they are enabled to register with each other in the process of building, and to bind the work together in such a manner that it shall form a mass incapable of being riven asunder or cracked. The bricks are to be formed with projections or tongues across or along one surface, and with grooves or recesses of corresponding size on the opposite side, whereby they may be laid down one on the other, with the aid of a small quantity of mortar or Portland cement, in such order as to fit or bind together the upper layer with the lower layer, and to tie each other longitudinally and crosswise, so as to prevent any lateral or transverse deviation or fissure occurring in the work. With regard to bricks for arches, a similar system of construction is adopted, by means of which it is evident that centres will not be required in the construction of arches and vaults, for as soon as one single layer of bricks has been thrown across the arch the series may be continued by inserting the second layer into the first, into which it will register and be self-supporting, and so on with the entire length of arch, or tunnel, or vault. *Patent completed.*

2100. J. Leetch and B. Mathew. *New and improved method of protecting the surfaces of iron or other metal work from oxidization, incrustations, or accumulations of any kind, more especially in the cases of ships' bottoms, steam-boilers, and machinery.* Dated July 24, 1862.

This invention is intended to be applied, chiefly, to metal ships, or to metal plates to be employed in the construction of ships, but it is applicable to metals and metallic surfaces generally. The invention consists, first, in protecting the iron by means of a glaze or vitreous compound, or by means of glass applied in a manner which we cannot here quote in detail. The second part of the invention consists in fixing glass upon metal surfaces with the interposition between the metal and the glass of a composition, which not only serves as a cementing medium, but also acts as a soft cushion for the glass. *Patent completed.*

2101. J. Dickson. *Improvements in treating copper ores and solutions of copper, to obtain copper therefrom.* Dated July 24, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2102. J. Horton. *Improvements in breech-loading firearms.* (A communication.) Dated July 24, 1862.

This consists in certain improvements in breech-loading firearms, whereby the firearm is charged with bullet and powder, and primed with a percussion cap, and the parts of the lock brought into position for firing by the depression and subsequent raising of a lever, situated on the under side of the gun, and forming the trigger guard. *Patent abandoned.*

2103. W. Clissold. *An improved mode of manufacturing cylinders.* Dated July 24, 1862.

This invention consists in manufacturing cylinders of wood and iron, as described with reference to the drawings. *Patent completed.*

2104. H. Rawson and F. Staples. *Improvements in machinery for combing wool and other fibres.* Dated July 24, 1862.

This invention has reference to a previous patent dated 28th April, 1860 (No. 1083.) In the machine described in the specification of that patent, a moving comb, called a reciprocating comb, is used, in combination with a travelling comb, so that, when the two combs are together, the sliver or fleece of wool or other fibre is placed into the teeth of the two combs, so that the end or fringe of the fibres projecting beyond the teeth of the reciprocating comb is placed in and beyond the teeth of the travelling comb. According to these improvements, the reciprocating comb is formed of three parts, two of which are fixed to the reciprocating table which carries the reciprocating comb. A space is left between the two fixed parts, in which the third or moveable part of the reciprocating comb is placed; and such third part is capable of being moved independently of the other two parts, which simply move with the table to and from the travelling comb (as described in the previous patent), so that the protruding fringe of the sliver or end of the fibres may be placed into and left in the teeth of the travelling comb. The sliver of wool or other fibre is out of the teeth of the reciprocating comb at the time the reciprocating comb comes up to the travelling comb. The sliver of wool or other fibre, when the travelling comb and reciprocating comb have come together, is pressed into the teeth of both of them; the reciprocating comb is then moved away from the travelling comb at this time. In the present arrangement, the third or moveable comb is traversed in the space which divides the two fixed parts of the reciprocating comb, and its movement is in a direction towards the travelling comb; by this movement the wool or other fibre across the space between the two fixed parts of the reciprocating comb will be combed. The sliver is then lifted out of the teeth of the reciprocating comb, and the third or moveable part of the reciprocating comb is traversed back, whilst the sliver is out of the teeth of the several parts of the reciprocating comb. The sliver also, whilst it is out of the teeth of the reciprocating comb, is moved a distance forward, so that that part of the projecting fringe of the sliver in which the wool has been accommodated by the third or moveable part of the reciprocating comb, when the combs next come together, be placed into the teeth of the travelling comb. *Patent completed.*

2105. T. Lemaistre. *Improvements in privies.* Dated July 24, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2106. J. G. Clarke. *Improvements in scythes.* Dated July 24, 1862.

This invention consists in forming the heel of a scythe blade with a recess, and so that it may be fixed by a wedge in a hollow socket, which is fixed or formed, by preference, on the end of a tube, which is passed into and fixed in a hole formed up the lower end of the sneath or handle of a scythe. *Patent completed.*

2107. W. H. Perkin. *Improvements in printing and dyeing when aniline and analagous coal tar dyes are employed, also in preparing colouring matters.* (A communication.) Dated July 24, 1862.

According to one part of this invention, in printing and dyeing with aniline and analogous coal dyes, the patentee uses as a mordant, arsenious acid, or a salt or compound thereof, and this he uses in combination with alumina. In printing, he prefers to mix together arsenite of soda, acetate of alumina, and the dye, then to print the fabric with this compound, and afterwards to steam it; the several materials may, however, be applied separately. The colouring matters which he prefers to employ are those known commercially as "aniline purple," "violet imperial," "regina purple," "Cleu de Lyon," and "Magenta." The following method of preparing the mordant for use with the colouring matter for printing is applicable more especially when "aniline purple" or "violet imperial" is used:—To two parts of acetate of alumina, having a density of 10 deg. Beaume, eight parts by weight of arsenite of soda are added, and after well stirring this mixture the colouring matter is added either in the form of a fine precipitate, or dissolved in any convenient solvent, in the proportion of about 16 parts of dry colouring matter to the 1000 parts of acetate of alumina. If the precipitated colour be used, it is best to use it in a wet state. When Magenta is used a better result is obtained, if 136 parts of arsenite of soda be used instead of 80 parts. The colours thus prepared are thickened with starch, gum, or other suitable material, and printed on to the fabric, which is then dyed, steamed, and washed in the usual way. *Patent completed.*

2108. W. Clark. *Improvements in machinery for the manufacture of fishing and other nets.* (A communication.) Dated July 24, 1862.

The patentee claims the improved machinery for the manufacture of fishing and other nets (as described and represented in the drawings) which consists in reducing the number of the working parts, so as to render their action more direct, and permitting of greatly increasing the speed at which the machine is driven, and reducing the labour, and, consequently, the cost at least one-third. He also claims the friction mechanism as and for the purposes described. *Patent completed.*

2109. M. Henry. *Improvements in apparatus for retarding and stopping carriages, especially applicable to railway carriages, and in disconnecting apparatus for carriages.* (A communication.) Dated July 24, 1862.

According to this invention breaks may be applied and caused to stop or retard carriages by the action of uncoupling or disconnecting the carriages from each other, in the case of trains. In one arrangement a chain or like agent, extending to within easy reach of the driver or other attendant, is connected under each carriage to a bar, rod, or shaft, called a disconnecting shaft. Each coupling hook is held to the carriage by a bar, rod, or piece, herein called a "key," kept in place by a moveable notched or hooked piece connnected to the disconnecting shaft by a crank link or jointed lever. When the chain is pulled or drawn, the disconnecting shaft is turned partially round, or oscillated, so as to move the notched or hooked piece, and release the key therefrom, whereupon the key is forced upward by a spring, and liberates the coupling hook from the carriage, an action which the momentum of the latter facilitates. The same action of the disconnecting shaft that disconnects the carriages also works the breaks. For this purpose the said shaft operates the breaks preferably through links, arms, or cranks actuating the links. *Patent abandoned.*

2110. H. A. Jowett. *Improvements in obtaining motive power, and in transmitting the same from place, and in apparatus connected therewith.* Dated July 25, 1862.

Here the patentee proposes to obtain compressed air as a motive power for transmission by pumps for that purpose worked by steam engines, and by pipes or tubes connected therewith to collect the same into reservoirs or receivers. The reservoirs or receivers will be supplied with air gauges for the purpose of always ascertaining the precise pressure thereon, and regulating the same. There will also be safety-valves on each reservoir or receiver, in the manner used for ordinary steam-engine boilers. He proposes also to obtain compressed air as a motive power for transmission by a fall of water in tidal rivers or reservoirs of water, having a natural or artificial fall of water, to set in motion the requisite machinery, that is to say, water-wheels, turbines, Barker's mill, or hydraulic ram, for working pumps to condense or compress air, and through pipes or tubes to collect it into reservoirs or receivers, and to transmit such air from one place to another, where motive power is required, by one or more main pipes or tubes placed under streets or highways, or otherwise connected with the central reservoir, or one of the branch reservoirs, as is adopted by gas and water-works establishments. *Patent completed.*

2111. J. Redgate and H. Redgate. *Improvements in machinery or apparatus for the manufacture of fabrics on bobbin net or twist lace machines.* Dated July 25, 1862.

This relates to apparatus known as the circular, the levers, and the single and double-locker machines, and consist in an arrangement in which the patentees employ a bar in or upon which is secured a number of instruments, each of which is somewhat thicker in depth than in width. Each instrument has a slot in the direction of its depth proceeding from the upper side thereof; in this slot is a thin bar which has a knife edge on its lower side, and is free to move endwise, and upwards and downwards, such movements being effected by a mechanical contrivance at one or both ends of the machine. They lower these instruments to a certain depth, and bring the front and back point bars in their turn upward between these said instruments, and place one, two, or more warp threads in front of the centre of the machine, and the requisite number for making the fabric at the back of the centre of the machine. The threads in front, as they are traversed to the right and left, are taken up by the point bars, one or more of such warp threads passing round one or more of the before-mentioned instruments, and also passing round one or more of the bobbin threads to form a looped pile on the face of the fabric. When they wish the pile to remain uncut, they use the said instruments without a knife, and cause them to be brought slightly forward at the same time as they rise out of the pile, when the instruments will again descend ready for forming another series of piles. But when they desire to form a cut pile on the fabric, they dispense with the forward and upward movements of the instruments, and keep them stationary, using the knife, to which they communicate motion as above described, so that as the pile is formed and the fabric is carried up to the work beam, the knife will cut the pile and free the work from the instruments. In either case, however, they sometimes shog the instrument bar to the right and left one or two gates, according to the fabric required to be made, and the number of instruments used. *Patent completed.*

2112. J. Anderson. *Improvements in separating gluten from starch, and in preparing gluten for food.* Dated July 25, 1862.

The patentee claims, 1, the separating of the gluten and starch of wheat flour by the action of a revolving shaft with arms in a trough, aided by jets of water, substantially a described. 2. The using of warm water to assist the separation of the gluten and starch, as described. 3. The coagulating or converting of the gluten by heat, substantially as described. 4. The completely drying of the gluten after coagulation, substantially as described. 5. The preparing of the gluten for food, substantially as described. *Patent completed.*

2113. P. Robertson. *Improvements in producing brushing or frictional surfaces.* Dated July 25, 1862.

This relates to the production of brushing or frictional surfaces of vulcanized or manufactured rubber in an improved manner, and it consists in moulding the rubber in sheets of convenient size, the moulds being shaped so as to produce on one side of the sheet a series of short projecting points or pins, which points or pins form the actual brushing or frictional surface. *Patent completed.*

2114. W. Clark. *An improved apparatus for decanting wine.* (A communication.) Dated July 25, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2115. J. Seymour and D. G. Hatcher. *Improvements in steering ships, and in apparatus for the same.* Dated July 25, 1862.

This relates to the application of blades or surfaces to both sides of ships for the purpose of steerage, either as an auxilliary to the ordinary rudder, or in case it should be carried away. These surfaces the inventors prefer to place on each quarter of the ship at a sufficient depth below the water line, and they recess them in the side of the ship, so that when not in use they are flush, and present no obstacle to the passage of the vessel through the water. Each of these surfaces are mounted on an axis or pivot at the forward part, and have motion thereon similar to the action of the rudder; this may either be communicated through the axis itself, or by a curved bar fixed to the plate or surface, and passing through a stuffing box in the ship's side; the curve is described by a radius taking the pivots as a centre. *Patent abandoned.*

2116. W. Clark. *Improvements in rafts or structures applicable for the ordinary purposes of marine and inland navigation, as also for saving life in cases of shipwreck or otherwise.* (A communication.) Dated July 25, 1862.

This apparatus is formed of four barrels, tuns, or hollow cylinders, carrying a light bridge-like structure. The inventor also applies this principle for the purposes of navigation. Thus he proposes to use hollow barrels or closed cylinders, each having a longitudinal axis, which allows of their turning so as to obey the least tractive force. *Patent abandoned.*

2117. V. Manzini. *Certain improvements in the construction of locomotive engines used on railways for facilitating and controlling the ascent and descent of locomotive engines and trains on inclined planes of lines of railway, and for simplifying the construction of locomotives used on railways.* Dated July 25, 1862.

This consists, 1, in dispensing with nearly all the mechanism at present employed, and further in employing only one steam cylinder instead of two, and in fixing the said cylinder to the side framing of the locomotive midway between the driving wheels of the engine. It is also proposed by this invention to employ a rotating piston, and to fix driving cranks in opposite ends of a shaft, to which the said piston is fixed, the said cranks to be connected each to a rod for coupling the wheels together, and imparting rotatory motion direct thereto as the piston rotates. Another improvement, according to this invention, relates to the wheels thereof, and consists in adapting thereto and across the face thereof bars of metal, capable of sliding so as to bring each end thereof successively into contact with an auxiliary wooden or iron rail fixed outside of the permanent iron rails, and at a short distance therefrom, at all the inclined parts of the line of railway, for preventing the skidding of the driving wheels of the engine whilst ascending inclines, and to retard and regulate the motion of the engine whilst descending inclines. *Patent abandoned.*

2118. E. Comfort. *Improvements in watch protectors.* Dated July 25, 1862.

In carrying out this invention the inventor proposes to attach a loose ring to a small metallic compound ring and bar; the loose ring is allowed to enter the waistcoat through a small opening in the lining, and the bar remains behind and outside the pocket. The watch-chain or guard is to be passed through the loose ring, and the other end is to be placed round the neck or through the button hole of the vest. When an endeavour is made to withdraw the watch, by pulling the chain or guard, the bow of the watch is dragged against the ring, and, consequently, prevented from being drawn any further. The wearer, however, by taking hold of the bow of the watch, can always withdraw it. *Patent abandoned.*

2119. A. Lahousse. *An improved construction of railway wheel.* Dated July 25, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2120. E. Tysall. *An improved manufacture of fork.* Dated July 25, 1862.

The object of this invention is to construct dinner and dessert forks, so that, without producing any material change in the appearance of such forks, they will, when in use, be enabled to carry up to the mouth together with the viands, a supply of gravy, sauce, &c. The prongs are made of the usual proportions, and of such configuration that, when looking at the back of the fork, it will present the usual appearance. The inner faces (or front) of the prongs are indented with channels or grooves, which increase in depth from the point upwards, until they are stopped at or near the roots of the prongs. These grooved prongs, while the fork is used for carrying food to the mouth, act as narrow scoops for taking up any liquid matters that may be applied to the viands. *Patent completed.*

2121. T. Pagar and J. Rocliff. *Improvements in moulding.* Dated July 26, 1862.

This is applicable to that description of moulding known as plate moulding, and consists in certain improvements in the mode of constructing the parting plates for producing the moulds requisite in casting iron, brass, and other moulds. The invention is not described apart from the drawings. *Patent completed.*

2122. A. V. Newton. *An improved mode of attaching armour plates to ships.* (A communication.) Dated July 25, 1862.

Here the ships' hull is covered to any desired extent with their plates secured by screws, and so arranged as to leave channels between their edges. Over these are laid, so as to break joint, other plates which are applied plate by plate, and kept apart by temporary backing pieces from the first skin of armour plates. Between the inner and outer plates fusible metal is run, so as to form a slightly yielding backing, which metal also fills the space between the edges of the first skin of armour plates. The edges of the overlying lines of plates as they are applied, are kept apart by temporary filling pieces, and these spaces are closed by strips of metal secured in position by clamping nuts. The fusible metal is then run in between the inner and outer layers of plates, and the plates are thus held firmly in position. The metal strips for confining the metal may then be struck off. The above process is repeated as often as required, until the desired thickness is obtained. *Patent abandoned.*

2123. W. Clark. *Improvements in obtaining or extracting silvers from ores and other bodies, and in apparatus for the same.* (A communication.) Dated July 26, 1862.

This consists in the extraction of silver from the extraneous matters in which it is found by certain processes, which are distinguished by the substitution of ammonia, or other bodies, suitable as solvents of the argentiferous compounds, instead of the mercury usually employed. *Patent abandoned.*

2124. J. H. Selwyn. *Improvements in apparatus employed in paying out and raising electric telegraph cables.* Dated July 26, 1862.

Here a buoy is used, which is kept at a distance from the machinery or apparatus employed for paying out or raising the telegraph cable. From this buoy the apparatus is suspended, so as to hang at a distance below the surface of the water. The apparatus consists of certain grooved pulleys, so arranged as to hold the cable and prevent the end from sinking in the event of breakage. *Patent completed.*

2125. T. Long. *Improvements in the manufacture of open metal works, applicable to various useful purposes.* Dated July 26, 1862.

This consists in making a number of slits in a flat sheet of metal, such slits being made in straight or curved lines or rows; the slits in each line or row being made to break joint with the adjoining lines or rows, a smaller portion of the metal being left uncut between the ends of the several slits. The sheet is now stretched out so as to open the slits. The edges of the sheet are turned up, and a length of wire inserted therein. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Oct. 15, 1862.

2783. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in refrigerating and freezing, and in apparatus employed therein. (A communication.)

Dated Dec. 12, 1862.

3329. J. E. Roussel, 15, Passage des Petites Ecuries, Paris, merchant. Improvements in hand and power looms for weaving. (A communication.)

Dated Dec. 16, 1862.

3363. R. Schomburg, Onslow-terrace, and A. Baldamus, Surrey-terrace, Lorrimore-road. Improvements applicable to all kinds of oils used for illuminating purposes, whereby combustion thereof is rendered more perfect, smoke prevented, and the purity of the light increased.

Dated Dec. 20, 1862.

3403. F. W. Harvey, High-street, Putney. Improvements in fitting and connecting rudders to ships and other floating vessels.

Dated Jan. 10, 1863.

89. L. H. E. Lepreux, Bordeaux. Improved plates or slabs for preserving apartments from the effect of damp, and which are also applicable in the composition of plinths and foundations for walls. (A communication.)

Dated Jan. 12, 1863.

95. W. Clark, 53, Chancery-lane, engineer. Improvements in winding or copping frames. (A communication.)

Dated Jan. 15, 1863.

137. J. P. Bath, Aigburth, near Liverpool, coach proprietor. Improvements applicable to omnibuses and other like carriages, to adapt them for use on rail or tram roads, as well as common highways.

Dated Jan. 20, 1863.

166. A. Paul, Gwennap, Cornwall. Improvements in obtaining reciprocating motion in steam-engines, and for communicating the same to any ordinary pumps, for whatever purpose they may be employed.

171. H. A. Bonneville, 24, Rue de Mont Thabour, Paris. Improvements in colouring, bronzing, and preserving iron and steel. (A communication.)

173. W. Clark, 53, Chancery-lane, engineer. Improvements in looms for weaving textile fabrics. (A communication.)

174. J. Smith, Barkeley House, Seaforth, near Liverpool, and S. A. Chease, Egremont, near Birkenhead. A new description of motive power engine.

Dated Jan. 21, 1863.

181. J. M. Kirk, Halifax and Bradford, dyer and finisher. An improved method of and means or apparatus for finishing textile fabrics.

183. J. Holt, Oldham, machinist. Improvements in willowing and opening cotton and other fibrous substances.

185. W. Clark, 53, Chancery-lane, engineer. Improvements in preparing and obtaining photogenic pictures or representations. (A communication.)

187. E. Bazin, Angers, France, engineer. An improved log.

189. Sir C. Lindsay, 11, Grosvenor-square. Improvements in apparatus to be used on railways to indicate to the engine-driver of a carriage train the length of time which has intervened since the passing of a previous train.

191. N. Clayton and J. Shuttleworth, Lincoln. Improvements in rotatory screens suitable for screening wheat and other grain or seed.

193. H. Holcroft, Rue de la Grandière, Tours, France, civil engineer. Improved machinery for separating substances of different specific gravities.

195. J. C. Brandès, 24, Rue Dunkerque, Paris. An improved hair creaser or divider.

Dated Jan. 22, 1863.

197. J. Ellacot, Liverpool, surveyor. Improvements applicable to spur wheels, racks, and other toothed gear, to insure greater strength in the teeth.

199. R. Penney, Carrbrook, colour mixer. An improved solution or mixture for "fixing" certain colours employed in printing calico and other fabrics.

201. W. Clark, 53, Chancery-lane, engineer. An improvement in piston valves and other pistons. (A communication.)

203. T. Lambert, Short-street, Lambeth, hydraulic engineer. Improvements in apparatus for drawing off water or other fluids.

205. F. W. Morley, Bedford, engineer. Improvements in boilers for steam-engines, and in valves to be used therewith.

Dated Jan. 23, 1863.

207. A. Henderson, Dundee, spinner. Improvements in the preparation or manufacture of textile materials, and in the machinery or apparatus used therein.

209. C. Stopford, Bristol, hat and cap manufacturer. Improvements in the construction of hats and other coverings for the head.

210. F. N. Gisborne, 3, Adelaide-place, London-bridge, engineer. Improvements in the means of communicating signals on board ship, and of indicating the position of the rudder.

211. W. Clark, 53, Chancery-lane, engineer. Improvements in mariners' compasses. (A communication.)

213. C. Turner, Airedale Felt Mills, Hunslet. Improvements in the manufacture of felted fabrics.

Dated Jan. 24, 1863.

215. A. O. Glossop, Sheffield, silversmith. Certain improvements in the construction and manufacture of breakfast cruet and liquor frames used in dinner and other services.

217. W. Allen, Cheadle, cotton spinner, and W. Johnson, Newton Moor, manager. Certain improvements in machinery or apparatus for grinding or pointing the "cards" employed in carding engines.

219. E. and G. Booth, Gorton, near Manchester, gum and chemical manufacturers, and A. Swallow, Staleybridge, colour mixer. Certain improvements in the mode of fixing colouring matter on cotton, silk, wool, and other fibres and materials, and certain improvements in finishing such like and other textile fabrics and yarns.

221. W. Clark, 53, Chancery-lane, engineer. Improvements in syphons applied to draining, irrigation, and other purposes, whereby they self-suspend and resume action according to requirements. (A communication.)

223. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the manufacture of anvils and other metal articles requiring hard surfaces. (A communication.)

225. F. Tolhausen, 17, Faubourg Moutmatre, Paris. Improvements in machines for carding fibrous materials. (A communication.)

Dated Jan. 26, 1863.

226. W. F. Stanley, 3, Great Turnstile, mathematical instrument maker. Improvements in mathematical drawing instruments.

229. J. Fyfe, Greenock, valve maker. Improvements in safety apparatus for steam-boilers.

231. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in petticoats or crinolines. (A communication.)

Dated Jan. 27, 1863.

232. H. H. Henson, 13, Parliament-street, Westminster, engineer. Improvements in fabrics for covering floors, walls, roofs, and other surfaces or objects, which fabrics are also partly applicable to the manufacture of waterproof articles.

233. G. Davies, 1, Serle-street, Lincoln's-inn, civil engineer. Improvements in preserving provisions, and in the apparatus employed for such purpose. (A communication.)

235. C. F. Ash, 20 and 21, Upper Thames-street, iron merchant. Improvements in the manufacture of cornices, joints, and laths of bedsteads, and other articles of furniture.

237. W. Rollason, Birmingham, manufacturer. Improvements in the manufacture of metallic boxes.

239. J. Edmonson, Frizinghall, near Bradford, York, manufacturer, and T. Ingram, Bradford. Improvements in looms and apparatus for weaving.

240. T. Gordon, 41, King-street, Soho. An improved method of, and apparatus for, damping and affixing postage stamps to letters.

241. D. E. Hughes, Gresham House, Old Broad-street, electrical engineer. Improvements in means or apparatus for effecting telegraphic communications.

Dated Jan. 28, 1863.

243. H. B. Barlow, Manchester. Improvements in preserving timber, and in apparatus employed therein. (A communication.)

245. T. Parkinson, Bury, cotton spinner. Improvements in carding engines.

247. E. F. Prentiss, Birkenhead, manufacturing chemist, and J. C. Sellars, chemist. Improvements in treating rock oil, petroleum, paraffin, and other like mineral oils, and products therefrom.

249. H. O. Cook, late lieutenant Indian navy, and E. G. Terrey, 12, Lower Clifton-street, Finsbury. Improvements in propelling ships and vessels, and in apparatus employed therein.

251. R. Ward, Newcastle-on-Tyne. Improvements in locking-up or fastening forms of type or other printing surfaces.

253. J. Platt, 10, Charlotte-street, engineer. Improvements in rotatory engine.

257. J. H. Johnson, 47, Lincoln's Inn-fields, gentleman. Improvements in the manufacture of braid, and in machinery or apparatus employed therein. (A communication.)

259. E. G. Muntz, Birmingham, manufacturer. Improvements in securing axles and axle boxes.

Dated Jan. 29, 1863.

276. F. G. Stuber, teacher, 1, St. James's-road, Brixton. Improvements in the construction of air-tight boxes, cases, cupboards, and similar vessels.

Dated Jan. 30, 1863.

278. W. E. Gedge, 11, Wellington-street, Strand. Improved apparatus for cleansing chimneys or other flues. (A communication.)

280. J. Cocker, Liverpool, gentleman. An improved turnstile especially applicable to omnibuses and other vehicles to show or indicate the number of passengers that have been carried.

282. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the couplings for railway carriages. (A communication.)

Dated Jan. 31, 1863.

284. M. Smith, Heywood, machine maker. Certain improvements in looms for weaving.

286. T. Bennett, Worcester, photographic artist. Improved arrangements for obtaining pictorial back-grounds, fore-grounds, and perspectives when taking photographic portraits or sun pictures.

288. F. Tolhausen, 17, Faubourg Montmartre, Paris, civil engineer. New or improved apparatus for cleaning the beams of mules and spinning frames, collecting the dust and waste thereof, and also for cleaning the flooring underneath the mule carriages. (A communication.)

Dated Feb. 2, 1862.

292. F. G. Grice, West Bromwich, manufacturer. Improvements in machinery for the manufacture of bolts, spikes, rivets, and screw blanks.

296. W. C. Barnes, Royal Small Arms Factory, Enfield. Improvements in means or apparatus for shaping, rolling, or compressing metal.

Dated Feb. 3, 1863.

300. C. Smithies, Manchester, commission agent, and G. L. Smithies, clerk. Certain improvements in preparing and bleaching "rheea," and other fibrous materials and fibres, which improvements are also applicable to bleaching yarns or piece goods.

302. G. Holcroft, Manchester, consulting engineer. Improvements in preparing cotton for the operations of spinning and weaving.

304. J. Fletcher, Droylesden, near Manchester, engineer, and H. Bower, Halifax. An improved injector or apparatus for feeding boilers with water.

306. T. L. Jacobs, Burton-on-Trent, cooper. An improved mode of, and apparatus for, cleaning casks.

308. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in reflectors. (A communication.)

Dated Feb. 4, 1863.

310. J. Mellor, Ardwick Chemical Works, Manchester, manufacturing chemist. Improvements in apparatus to be used in distilling, subliming, and drying.

312. T. Bradford, Cathedral-steps, Manchester, washing machine manufacturer. Improvements in machinery or apparatus for washing, wringing, and mangling clothes or other textile fabrics.

314. G. T. Bousfield, Loughborough-park, Brixton. Improvements in postage revenue, and other stamps, and in

apparatus for post marking and cancelling postage and other stamps. (A communication.)

Dated Feb. 5, 1863.

324. J. Gill, bleacher, Far Headingley, near Leeds, and J. Parkin, manager. Improvements in apparatus for polishing yarn, twine, threads, and other similar materials.

326. H. Dircks, Blackheath, civil engineer, and J. H. Pepper, 309, Regent-street, professor of chemistry. Improvements in apparatus to be used in the exhibition of dramatic and other like performance.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, Feb. 17, 1863.

2678. J. and W. Lee. Traction engines and boilers.

2698. J. Newnam. Crystallizing, and for evaporating.

2710. H. D. P. Cunningham. Working the guns, and in performing necessary work on board ships, and in apparatus employed therein.

2711. J. K. Hampshire. Apparatus or machinery for washing coal, coal slack, and other mineral substances.

2712. J. and M. A. Beale. Preparation or manufacture of manure.

2714. C. F. Terry. Propelling vessels.

2728. A. V. Newton. Breaking and cleaning fibrous substances. (A communication.)

2731. L. Hosch. Constructing travelling trunks and ortmanteaus.

2733. R. E. Green and J. Cockcroft. Amalgamation of materials.

2739. E. Weallens. Surface condensers.

2741. J. J. Shedlock. Gas-meters.

2743. A. Vennedy. Composition for covering and forming the tips of umbrellas and pararols.

2744. R. A. Brooman. Breech-loading firearms. (A communication.)

2747. T. Bouch. Charging or filling cartridges.

2752. A. F. Gallis. Covering street omnibuses.

2755. W. Loeder. Projectile to be used with ordnance or firearms of any calibre. (A communication.)

2770. R. A. Brooman. Carburetting gas. (A communication.)

2779. J. Taylor. Temples for looms.

2781. C. de Bergue. Permanent way.

2783. P. Potenza. Extraction, preparation, and spinning of the silky fibre contained in the bark of mulberry trees.

2787. R. A. Brooman. Felting machines. (A communication.)

2789. R. A. Brooman. Refrigerating and freezing. (A communication)

2797. E. Humphreys. Steering apparatus.

2708. H. Ransford. Building ships and other vessels.

2802. E. Nelson. Heating and superheating steam and air without decomposition.

2808. J. H. Johnson. Prevention or removal of incrustation. (A communication.)

2810. E. Lord. Opening and cleaning fibrous substances.

2816. W. E. Gedge. Extracting condensed steam. (A communication.)

2817. W. Clark. Dredging. (A communication.)

2844. E. Fielding. Manufacture of healds.

2846. H. H. and J. F. G. Kromschroeder. Manufacture of gas-metres.

2905. J. Jeffreys. Heating and cooling fluids.

2907. A. Ripley. Pistons.

2209. G. Darlington. Manufacture of zinc oxide.

2913. W. Clark. Treatment of copper ores. (A communication.)

2946. G. Speight. Manufacture of collars.

2965. L. Gonez. Seat or chair.

3155. W. Tatham. Preparing and spinning fibrous materials.

3366. W. Tongue. Preparing fibrous materials.

160. Sir W. O'S. Brooke. Insulators

191. N. Clayton and J. Shuttleworth. Rotary screens, screening grain or seed.

196. J. Grant. Construction of sidings and loop lines for railways or tramways.

199. R. Penny. Fixing certain colours.

217. W. Allen and W. Johnson. Grinding or pointing cards employed in carding engines.

220. M. A. F. Mennons. Punching and cutting metals. (A communication.)

233. G. Davies. Preserving provisions. (A communication.)

270. N. Clayton and J. Shuttleworth, Thrashing machines.

300. C. and G. L. Smithies. Preparing and bleaching fibrous materials and fibres.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Feb. 13, 1863.

2299. J. Barclay.
2311. S. A. Bell and T. Higgins.
2315. J. T. Oakley.
2321. V. F. Clenet.
2323. S. Boucher.
2326. J. G. Tongue.
2327. W. Whittle.
2331. J. Standish and J. Gooden.
2335. J. C. Schoenmann.
2341. S. F. Griffin.
2357, M. K, Angelo,
2361. M. J. Haines.
2398. F. H. Lefranc.
2436. F. C. Bakewell.
2455. J. S. Margetson.
2467. W. A. Richards.
2513. J. Thom.
2530. W. G. Rawbone.
2655. J. Wright.
2768. D. R. and C. J. Reid.
2245. M. C. de C. Sinibaldi.

Sealed Feb. 17, 1863.

2332. S. Wilkes.
2338. T. Clements, P. and J. Llewellin, and J. W. James.
2344. W. Barrett.
2346. J. Mackay.
2348. H. Twelvetrees.
2352. W. Carwood, W. Boaz, and C. Colwell.
2421. W. Clark.
2446. W. Clark.
2486. M. Smith.
2502. W. Clark.
2512. J. B. Smith.
2550. J. Simpson.
2557. P. H. Whitehead.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

349. J. C. Lupton and J. Bleasdale.
359. D. Auld.
368. D. Dietz.
367. H. D. Denison.
379. W. Mitton and J. Penney.
386. J. Green.
394. W. Clark.
399. W. Leatham.
406. M. J. Haines.
419. J. G. Jennings.
420. E. Caplin.
423. G. Parsons.
438. J. H. Johnson.
430. J. H. Johnson.
480. S. S. Bateson.
481. T. Lovelidge.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

354. W. H. Harfield.
358. G. T. Bousfield.
366. S. Fox.
380. W. M'Farlane.
391. E. Oldfield.
403. H. J. Hyams.
419. C. S. Jackson.
438. J. Barsham.
618. P. Marcus.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending February 20, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
302	0	4	1965	0	4	1975	0	8	1985	0	8	1995	0	4	2005	0	4
1886	0	4	1966	0	4	1976	0	10	1986	0	8	1996	0	4	2006	0	10
1956	0	4	1967	0	4	1977	0	4	1987	0	4	1997	0	6	2007	0	10
1957	0	6	1968	0	4	1978	0	4	1988	0	4	1998	0	10	2008	0	6
1959	0	4	1969	0	10	1979	0	4	1989	0	4	1999	0	8	2009	0	8
1960	3	2	1970	0	6	1980	1	2	1990	0	10	2000	0	8	2010	0	4
1961	0	8	1971	0	8	1981	0	4	1991	0	10	2001	0	8	2011	0	4
1962	0	10	1972	0	4	1982	0	4	1992	0	4	2002	0	10	2012	0	4
1963	0	4	1973	0	8	1983	0	4	1993	0	4	2003	0	4	2013	0	8
1964	0	4	1974	0	8	1984	1	0	1994	0	6	2004	0	4	2014	1	4

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Timber, duty 1s. per load, drawback, 1s.

	£	s.	£	s.
Teak ....load	14	0	15	0
Quebec, red pine	3	10	4	10
,, yellow pine	3	0	4	0
St. John, N.B., yellow	5	0	5	10
Quebec oak, white	5	10	6	10
,, birch	3	0	3	10
,, elm	3	10	5	0
Dantzic, oak	3	10	6	10
,, fir	2	10	3	10
Memel, fir	3	0	3	5
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzig, fm.	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	19	10
St. John, white spruce	14	10	16	10
Yellow pine, per reduced C.				
Canada, 1st quality	17	0	18	0
,, 2nd do	11	0	12	0
Archangel, yellow	13	0	13	10
St. Petersburg, yellow	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white	9	0	9	10
Gefle, yellow	10	0	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.				
,, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
Pumice Stone, per ton	5	10	9	0

OILS, &c.

	£	s.	£	s.
Seal, pale ....per tun	47	10	48	0
Sperm body	85	0	86	0
Cod	47	10	48	0
Whale, South Sea, pale	44	0	0	0
Olive, Gallipoli	59	0	60	0
Cocoanut, Cochin	56	0	58	10
Palm, fine	39	0	39	10
Linseed	44	0	0	0
Rapeseed, English pale	55	0	0	0
Cottonseed	3	0	45	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
Iron:									
Welsh Bars, in London	per ton	6	10	0	to	7	0	0	2½
Nail Rods	,,	7	5	0	,,	7	10	0	,,
Hoops	,,	8	10	0	,,	9	0	0	,,
Sheets, single	,,	9	10	0	,,	9	15	0	,,
Staffordshire Bars	,,	7	15	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	17	6	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	14	0	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
Steel:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	10	0	,,	18	0	0	,,
Copper:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8½	,,	0	0	0	3to7½
Fine Foreign	per ton	96	0	0	,,	0	0	0	3
Tin:									
English Block	pr cwt.	5	15	0	,,	0	0	0	2½
Bar	,,	5	16	0	,,	0	0	0	,,
Refined	,,	6	0	0	,,	0	0	0	,,
Banca	,,	6	2	0	,,	0	0	0	nett
Straits	,,	6	1	0	,,	6	2	0	,,
Tin plates:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
Lead:									
Pig, English	per ton	21	5	0	,,	21	10	0	2½
Spanish, Soft	,,	20	10	0	,,	0	0	0	,,
Shot, Patent	,,	23	15	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	0	0	0	,,
Spelter:									
On the spot	,,	18	5	0	,,	18	7	6	nett
Zinc:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
Quicksilver	pr btl.	7	0	0	,,	0	0	0	3
Regulus of Antimony:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,

4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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The *Art Journal* of November, in its description of Benson's Great Clock, says:—"It has attracted universal attention; its construction has, we believe, obtained general and strong approval; it is one of the largest chiming clocks as yet manufactured in this country." Benson's new show rooms contain clocks designed by the first artists of the day, and include clocks for the drawing-room, dining-room, bed-room, library, hall, staircase, bracket, carriage, church, turret, railways, warehouse, counting-house, with musical, astronomical, and every description of clock, from the plainest to the highest quality of which the art is at present capable. Church and turret clocks specially estimated for. Benson's illustrated pamphlet on clocks and watches (free by post for two stamps) contains a short history of clock and watch making, with descriptions and prices; it acts as a guide in the purchase of a clock or watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any other part of the world, to select a clock. J. W. Benson received a Prize Medal and honourable mention.—33 and 34, Ludgate-hill. Established 1749.

THE MECHANICS' MAGAZINE.

LONDON, FRIDAY, FEBRUARY 27, 1863.

WROUGHT-IRON DIRECT FROM THE ORE.

AMONG the multitude of problems awaiting the solution of practical and scientific men is that of the production—with commercial advantage—of wrought-iron direct from the ore. We are aware that some attention has been given to the subject in this country, and that experiments to a limited extent have been made in several of the iron districts, with a view to accomplishing the desideratum. Hitherto, however, no amount of success worthy of record has been achieved, and the complicated and expensive processes of fusion in blast furnaces, refining, and puddling, are almost universally resorted to for the production of malleable iron. The fact exists, nevertheless, that much of the bar iron imported into England from abroad, is the result of direct conversion from the ore. It seems incredible that with infinitely greater advantages both in respect to abundance of fuel and variety of ores, we should lag behind in this important department of iron manufacture. Surely if persevering and well-judged efforts were made, the stigma of inferiority might be removed, and another branch might be added to the flourishing iron manufacture of Great Britain. Theory at least is in favour of direct conversion from the ore, and there is little reason to doubt that practice will eventually confirm the theory. At any rate it will be satisfactory to set the question at rest, and this can only be done by conducting experiments on a much more varied and extended scale than has yet been ventured upon. The probability is that in most of the attempts hitherto made for the accomplishment of the object, too much attention has been directed to what *has been* previously done, and too little to what *may be* effected. It is, indeed, too often the case that in the pursuit of scientific discovery the explorer is hampered by the teachings of predecessors rather than expedited by the conception of original ideas. There unfortunately exists in most minds a predisposition to move forward through the same grooves which have been opened up by others, and hence too often the same goal of failure and discouragement is reached. What is wanted is, as we have said, more originality of action, more working out of one's own thoughts, and less of slavish conformity to the dogmas and dicta of others. When these points shall be attained, the progress of discovery will be far more rapid than at present, and the world will benefit largely by the change.

Let those, therefore, who may be induced to embark in the enterprise of endeavouring to solve the question which has suggested the foregoing remarks, dismiss as far as possible from their minds the theories and peculiar modes of operation held and adopted by former labourers in the same field, and act out, as it were, their own convictions and experiences.

Not directly as a guide to the achievement of success, but rather as a beacon to warn them off the rocks of failure and disappointment, shall we now, therefore, briefly call the notice of our readers to the means heretofore employed in the production of wrought-iron immediately from the ore.

It is the ordinary practice to deal with ores intended for conversion as follows:—The raw material is first ground to a coarse powder, and then, in conjunction with a quantity of carbonaceous matter, similarly treated, it is charged into a reverberatory furnace, somewhat resembling an ordinary puddling furnace. The draught is forced to the production of a high temperature, thus reducing the ore to a semi-liquid state. By dexterous manipulation on the part of the attendant operative, metallic iron is separated from the extraneous matter, balled up, and shingled. The theory of this operation is simple. The carbon of the carbonaceous matter is consumed by uniting with the oxygen of the ore, and the metal is left free to agglutinate into a mass. The Beaufort black band ore was thus converted into malleable iron, though after a few experimental trials the operation was discontinued. The principal objection to its extensive adoption seems to lie in the difficulty of effecting a complete separation of the extraneous metalloids of the ore. In the blast furnace it is accomplished by mechanical subsidation in the hearth, and the extraction of the metallic iron from the low level. In the direct mode of manufacturing it is effected, to a certain degree, by severe manual labour, which, however, being skilled, commands a comparatively high price, and materially enhances the expense incident to the process.

The prolonged exposure of the metallic iron to the oxydising influence of the flame and gases, during the process of separation from the alloyed matters, results in a considerable waste of metal, and accounts for the comparatively inferior yields. To obviate this loss, and to economise the fuel and labour demanded, the ground ore and carbonaceous matter have (in some cases) been subjected to the necessary heat in a closed supplementary chamber, whereby the combustion of the carbon is slowly carried on at the expense of the oxygen of the ore, but at a sufficiently low temperature to avoid oxydizing the mass. From this chamber it is drawn as required into the furnace, balled up, and shingled, the deoxydized ore agglutinating without undergoing the puddling process, which, being essentially of a decarburizing character, is unnecessary with the minimum volume of carbon consumed in the deoxydation of the ore in the close chamber. Ground carbonaceous ore may be substituted for the carbonaceous matter, and mixed in the necessary proportions with the same ore calcined, or, with raw hematite, the deoxydation can then be effected without the usual ground coal, and at a considerable reduction of expense.

In this respect, as has been said, the possession of ores of such varied kinds as we have, gives the British iron-master an important advantage over his foreign rival. Possibly at some future day, and Truran, in his admirable work on Iron Manufactures, advances that opinion—this mode of manufacture may be more extensively and profitably adopted. The rich carbonaceous ores of Scotland or of Wales, mixed with the hematites of Lancashire or West Cumberland, or other similar ores, reduced in suitably-constructed furnaces, may be converted directly into malleable iron, at costs considerably under those incurred with the blast furnace and subsequent decarburizing system.

With existing modes of operation, the advantages of direct conversion are principally confined to the small amount of capital required to establish the manufacture, which, though conducted on the smallest scale, may yet be comparatively profitable. In new districts requiring an immediate small supply, and to countries deficient in the capital money for carrying on operations on a large scale, the direct conversion of the ore into wrought-iron is of especial consequence; but we have hopes that at home it will, by-and-bye, be not only extensively practised, but be found correspondingly profitable to those who succeed in effecting it. At all events the subject is one of great interest; and we cannot doubt that those who are connected with the iron manufacture will give to it due consideration, and that practical attention which it deserves.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES.

WE have on several occasions directed public attention to the anomalous and confused arrangements which exist in this country in reference to weights and measures; and it is certainly high time that the Legislature interposed for the purpose of simplifying those arrangements. It is discreditable that, while elsewhere improvements of almost every kind are being affected, in this department ancient usage rather than modern convenience should still reign supreme. The International Decimal Association has done much to clear the way for the introduction of a uniform system of weights and measures, and there can be little doubt that the public would speedily appreciate a change which must economise both time and money. The hour is, indeed, opportune for such a measure of social reform as we have indicated. The struggles of political parties which were wont to distract the attention of our representatives in Parliament from the real business of the nation, are not at present stopping the way, and thus a fair opportunity is afforded for considering deliberately such questions as this. A committee of the House of Commons unanimously reported last session in favour of a metric system of weights and measures, and came to the following detailed and distinct conclusions:—

1. That the use of the metric system be rendered legal, though no compulsory measures should be resorted to until they are sanctioned by the general conviction of the public.

2. That a department of weights and measures be established in connection with the Board of Trade. It would thus become subordinate to the Government and responsible to Parliament. To it should be entrusted the conservation and verification of the standard, the superintendence of inspectors, and the general duties incident to such a department. It should take such measures as may from time to time promote the use and extend the knowledge of the metric system in the departments of Government, and among the people.

3. The Government should sanction the use of the metric system, together with our present one, in the levying of the Customs' duties; thus familiarising it among our merchants and manufacturers, and giving facilities to foreign traders in their dealings with this country. Its use with that of our own system in Government contracts has also been suggested.

4. The metric system should form one of the subjects of examination in the competitive examinations of the civil service.

5. The gram should be used as a weight for foreign letters and books at the Post-office.

6. The Committee of Council on Education should require the metric system to be taught (as might easily be done by means of tables and diagrams) in all schools receiving grants of public money.

7. In the public statistics of the country, quantities should be expressed in terms of the metric system, in juxtaposition with that of our own, as suggested by the International Statistical Congress.

8. In private bills before Parliament the use of the metric system should be allowed.

9. The only weights and measures in use should be the metric and the imperial, until the metric shall have been generally adopted.

10. The proviso in the 5th & 6th William IV., cap. 63, sec. 6, should be repealed.

11. The department which it is proposed to appoint should make an annual report to Parliament.

These propositions are sufficiently explicit; and upon them we are not without hope that an Act of Parliament may, before the present session is passed, be based and carried into effect. At present as many as ten different systems of weights and measures are in use in this country. There is first the grain, computed decimally, which is used for scientific purposes; second, the troy weight, under 5th George IV., cap. 74, and 18th and 19th Victoria, cap. 72; third, the troy ounce, with decimal multiples and divisions, and called bullion weight, under the 16th and 17th Victoria, cap. 29; fourth, banker's weight, to weigh 10, 20, 30, 50, 100 and 200 sovereigns; fifth, apothecary's weight; sixth, diamond weight and pearl weight, including carats; seventh, avoirdupois weight, under 5th George IV., cap. 74, and 18th and 19th Victoria, cap. 6, sect. 72; eighth, weights for hay and straw; ninth, wool weight, using, as factors, 2, 3, 7, 13, and their multiples; and tenth, coal weight, decimal, under 1st and 2nd William IV., cap. 76, and 8th and 9th Victoria, cap. 101. We have also in occasional use the weights of the metric system. For measures of length we have the ordinary inch, foot, and yard. In cloth measure we have yards, nails, and ells. There are four different sorts of ells. For nautical purposes we have fathoms, knots, leagues, and geographical miles differing from the common mile. The fathom of a man-of-war is 6 feet; of a merchant vessel 5½ feet; and of a fishing smack 5 feet. There are also the Scotch and Irish mile, and the Scotch and Irish acre. We have in the United Kingdom several sorts of acres, and a great variety of roods. In almost every trade there are in use trade measures, specially employed in those trades. For the measurement of horses we have the hand; shoemakers use sizes; and we are compelled to use gauges where the French use the millimetre. The gauges are entirely arbitrary. The custom of the trade is the only means of deciding questions in dispute.

For measures of capacity there are twenty different bushels. Few can tell what the hogshead means. For ale it is 54 gallons; for wine it is 63 gallons. Pipes of wine vary in many ways; each sort of wine claims the privilege of a different sort of pipe. For measures of weight there are ten different stones; a stone of wool at Darlington is 18 lb.; a stone of flax at Downpatrick is 14 lb.; a stone of flax at at Belfast is 16¾ lb., but it is at the same place 24½ lb. The cwt. may mean 100 lb., 112 lb,, or 120 lb. If you buy an ounce or a pound of anything, you must inquire whether it belongs to Dutch, troy, or avoirdupois weight.

Such are some of the absurd arrangements which at present obtain in this country, the centre of commercial industry, and the heart of civilization. Mr. Leone Levi, who has taken much pains to inquire into these anomalies, is of opinion that the foregoing are but a portion of those which really exist. How necessary, therefore, is a revision and simplification of the conflicting systems! Surely they ought to be swept away *in toto*, and a simple and intelligible plan established in their lace!

We believe that a bill will actually be introduced into Parliament before long for effecting this desirable object; and we sincerely trust that the Government will have sufficient judgment to adopt it, and the two Houses decision enough to carry it through. Uniformity of weights and measures once fairly established, we might also hope for the introduction, at no distant period, of a Decimal system of coinage, which in itself would be a boon of incalculable value.

ROADS AND TRACTION-ENGINES.

There are some 22,000 miles of *turnpike* road in England and Wales, while a large sum is annually spent in keeping these highways in a passable state of repair. How shall we bring this great length of road under the dominion of King Steam? Ought we to lay down lines of rails at the rate of at least £5,000 to £10,000 per mile; or should we at once use traction-engines? However much the meshes of the great railway net spread over England are getting narrowed by the requirements of an extending communication, the map of the country still shows a comparatively small amount of railway mileage. The use of rails on a road trodden by horses and vehicles, has great practical difficulties in its wake; although, on the other hand, the mechanical economy of traction power undoubtedly requires an unyielding surface for the wheels. But it would cost an enormous sum to apply rails to ordinary roads, even if a line of rails did not clash with the requirements of highways, necessarily open to all descriptions of conveyances. Besides, unyielding surfaces in the shape of rails, cannot be carried up to every man's door. A steam link of communication, of more adaptability than a line of rails can ever be, will never cease to be a desideratum; and a system of traction, taking an intermediate position between railways and highways, will always be required. How would it be possible to have lines of rails along the narrow country lanes? The steam carthorse consumes only cheap coal; while animal muscles must be renewed with expensive hay and oats. Rails cannot well be put down in fields that have to be annually ploughed up. A system of steam cultivation has been certainly proposed, upon the basis of a connected system of rails laid down throughout the country. But this *mechanical* system would, probably, require a revolution in the whole *political* system to carry the plan out. We cannot wait for this. The great advantage of a traction-engines over a system of rails is, that traction-engines can be applied at once over the whole extent of the existing roads.

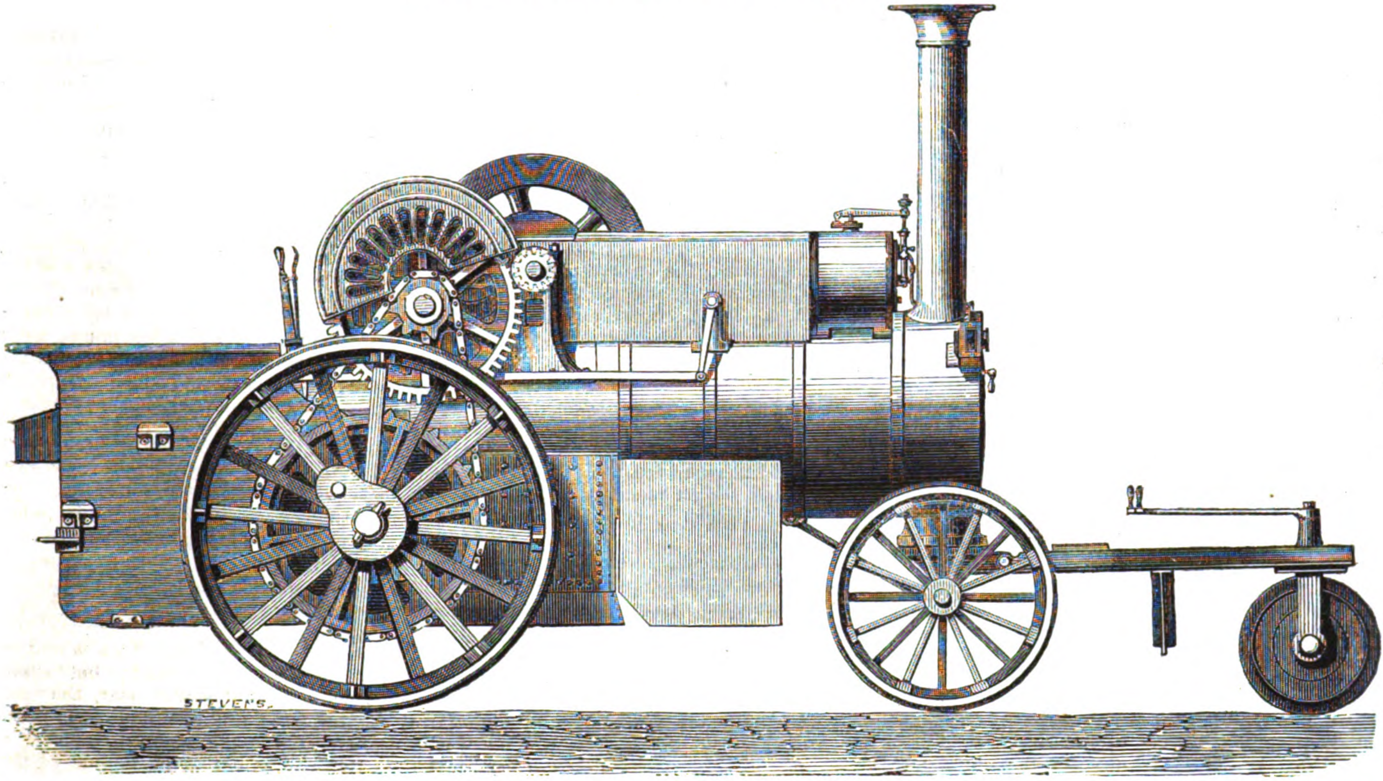
It has been feared that traction-engines will exert a destructive influence on the roads. No doubt this is the case to some extent. It is, however, well known to experienced road surveyors, that great injury to macadamised roads is caused by the hoofs of the horses. The relative damage done by the hoofs of horses in fast carriages, compared with that caused by the wheels, is about 3 to 1. Besides, the more traffic, the more tolls; while it is not improbable that improvements may be brought to bear on road surfaces, increasing their adaptability to the driving wheel of a traction-engine. It thus appears to us that the problem of an uninterrupted steam communication would be solved by gradually extending the present lines of rails, and in the mean time to communicate with the termini by means of steam traction-engines.

A great impetus has been given to the development of the self-propelling engine, by the extensive, and still extending, use of steam on the farm. The *direct* system of steam cultivation almost absolutely requires a traction-engine. It has been well observed that the sight of half-a-dozen horses dragging at a so-called *portable* engine, is an insult to mechanical science. The engine could exert perhaps ten times the power of the horses dragging it to its destination. Men whose business consists in hiring out portable steam-engines in the farming districts, must greatly feel the want of a self-propelling engine.

In many parts of the world; in South America, in Australia, and even in some parts of the Continent, there are valuable mines of copper, silver, etc., lying in the interior of the country, and situated hundreds of miles from a seaport. It would never pay to lay down a line of rails for the sake of a few mines, however valuable the property might be. On the other hand, centuries would elapse before the population could be dense enough to render a railway profitable. The great drawback to these mining undertakings has been the enormous expense of carrying the ore to the commencement of the water communication. At the same time, wood is plentiful, as it generally is in uninhabited districts. There is thus no want of fuel, and the abundant supply of wood is also generally used to form what the Americans call a "corduroy road," which consits of logs about a foot in diameter, laid side by side as close as possible. This would be an expensive road in England; but where wood is cheap, and labour is dear, the contrary is the case; and corduroy roads adapt themselves admirably to the requirements of the traction-engine. A good engine of this description is thus a mechanical necessity of the day. Most of the aspirations and wants of our time were more or less completely represented in the Great Show at Kensington. Accordingly, about nine of these engines were exhibited in the eastern annex of the International Exhibition. Several were crude and undeveloped specimens, exhibiting the weakness of some of the engine makers when treading on comparatively unbeaten ground—shall we say *track?*

The traction-engine that was perhaps the most admired by good judges for its combined simplicity and efficiency, and for its low prime cost, the usual accompaniment of simplicity, was the "exhibit" of Mr. Aveling, of Rochester. Its construction was a happy marriage of ingenuity with common sense. A nearly identical engine to the one in the Exhibition was also at work at the Battersea Agricultural Show of last year. The engine in the Exhibition weighed 8 tons empty, and about 10 tons when full. The cylinder was 10 inches in diameter, and 12-inch stroke. The fire-box was of Bowling iron, with stay-bolts pitched 5 inches from centre to centre. The boiler was flush from end to end. A pair of longitudinal stays placed below the tubes were made to connect the two tube plates. The fire-box was lagged, and the engine was counter-weighted. The driving wheels could be easily disconnected from each other, and from the propelling gear, by taking out a pin uniting the boss of the wheel with another boss on the axle; this is for easily turning round corners. There was a powerful friction break on the driving axle, in case of need when descending an incline. There was no steam dome, properly so called, on the boiler, but the cylinder was surrounded by a lagged metal jacket. This steam chamber is brought into direct communication with the steam by means of holes made in the top of the boiler, the cylinder being bolted thereon. The steam thus circulates constantly round the cylinder, and

AVELING AND PORTER'S PATENT TRACTION ENGINE.



there is no necessity for a steam pipe. The cylinder being placed close up to the chimney, the exhaust pipe is thereby very short, with its attending advantage of a small back pressure.

There will be little tendency to prime in this engine, as the cylinder is placed as far as possible from the fire-box, the place where the water is most agitated by the ebullition; the steam is dried by the dome-like properties of the peculiar construction of cylinder; and on ascending inclines, the cylinder is necessarily fed with dry steam. The steering apparatus is very simple; it consists of a single steering and carrying wheel, made to swivel on its supporting rod at the end of a light wrought-iron frame fitted to the front end of the smoke-box. A man sits in front of the engine, guiding the wheel in his hand, and the massive traction-engine behind is literally "led by the nose" by means of this simple steering gear. The self-propelling gear consists of a pinion on a feather at the end of the crank-axle, and working into a larger wheel on a stud below; on this wheel is cast a pinion with chilled teeth, to take in a pitch chain, made of massive iron links and steel pins. In the bracket carrying the axis of the drum, there is a curved slot in which the block for the stud of the small chain wheel can be made to slide. The curve of this slot is struck from the centre of the main driving-shaft above. The spur wheel thus always remains in gear with the driving pinion on the crank shaft. These were some of the peculiarities of the engine in the Exhibition. One of its most important features was the excellent construction of fire-box and boiler, enabling it to raise the high pressure of steam for exerting the great power required from a traction-engine.

By the courtesy of Mr. Aveling, we were lately enabled to see the performance of one of his peculiar traction-engines. The engine tried was one of the several now being manufactured at the Rochester Works for the Yudanamutana Copper and Mining Company, South Australia. The mines of the company are about 120 miles from Port Royal, and the ore has to be transported all this distance over an unbeaten track of ground. The traction-engines have to run ten miles at a stretch; there being water stations at every tenth mile. We believe that Messrs. Aveling and Porter are also making the fixed plant for the stations. The cost of carriage is said to be nearly £10 per ton, but as the fuel (wood) is cheap and plentiful, the traction-engines will probably reduce the freight to £2 per ton. In its main features the engine was similar to the one in the Exhibition, but it embodied several improvements and additions. The engine tried weighs, empty, 11 tons, and about 13 tons in working trim. The fire-box is 40 in. long, 31 in. wide, and 20 in. deep inside. The fire-box stay bolts are 4½ in. from centre to centre. The boiler is 3 ft. 1 in. in diameter inside, containing 37 lap welded tubes, 2¼ in. in diameter outside, and 5 ft. 7 in. long; the barrel and outer fire-box being of ⅜ plates, from Earl Dudley's Works; the inside fire-box is of the same thickness of plate; the fire-box tube plate and the door plate are ½ in. thick. The smoke-box tube plate is a round disc ⅝ thick, rivetted within the smoke-box; being flanged all round. The barrel of the boiler has butt-riveted joints and straps, and there are two longitudinal stays in the boiler barrel. The whole boiler is flush, and without any angle iron. The fire box is carefully lagged. The construction of the entire boiler seems to come up to the best standard of locomotive work, and is thus enabled to use the locomotive steam pressures of 100 to 120 lbs. in the square inch. The cylinder is 10 in. diameter and 12 in. stroke, like the cylinder of the Exhibition engine; it is cast from the same pattern, and arranged on a similar plan. On investigation, no inconvenience appeared to arise from their being only one cylinder, as the driver could easily take the engine off the dead points by turning the multiplying gearing at the other end. The steering gear is also the same. The working parts are neatly housed in from the influence of the weather. The toothed gearing was also covered with light cast-iron splashers. The chief differences between this engine and the one in the Exhibition consist in the mode of taking up the slack chain, and in the geariug being double, in order to get either two miles or four miles an honr speed of traction-engine.

There is a pinion at each end of the crank shaft; and either of these pinions can be thrown in and out of gear with the spur wheel below by sliding it along a feather on the shaft. The pinions are ingeniously kept in the positions required by means of a simple clip of spring steel, embracing the shaft, and lined with leather; it is quickly slipped off and on the shaft as required. The ratio of gearing obtained by the pinions and plate wheels is 1 to 20 on one side and 1 to 14 on the other. As in the Exhibition engine, the brass bearing carrying the large toothed wheel is fitted in a radial slot struck from the centre of the crank shaft. The adjustment for taking up the slackness of the chain is, however, effected in a different manner. The brass bearing is kept up in the slot by a block at bottom. There is another cast-iron block above, lying on the bearing and kept down by a set-screw. When the bulk of the chain has to be taken up, the thinner block below is taken out, and the thicker one above is substituted in its stead. The brass step is thus fixed in a perfectly firm and solid adjustable bearing. A neat plate covers up the whole.

The driving wheels are 6 ft. 6 in. in diameter, with a cast-iron rim, 18 in. wide, and a cast-iron nave 15 in. diameter. There are fourteen wrought-iron spokes, 2½ by 1 in., cast 3½ in. into the nave, the ends of the spokes being first notched and dipped into tar. The nave is cast one day after the rim, so that the contraction of the rim may not affect the strength of the wheel. The driving wheels of the Exhibition engine had blank spaces on the face, in order to slip T iron paddles or clips on to the wheels when passing over soft and yielding ground. In order to conform with the Locomotives Act, these openings are now filled up with small castings, dove-tailed in, and further fastened by pins. These castings are slipped off, when it is wished to put in the T iron clips. Spikes are also employed to increase the grip of the wheels. The bearings are inside the wheels. The driving axle is of scrap iron, 5 in. in diameter. The axle is fitted in axle plates fixed outside the fire-box, between the latter and the tank behind. Thus, although there is no longitudinal framing, the traction strain on the fire-box is, in a great measure, taken up by the intermediate grip of the wheels on the ground.

The weight is chiefly on the wheels, particularly on steep hills, which somewhat accounts for the remarkable performances of this engine. There are no springs, Mr. Aveling not judging them necessary for the slow speeds at which the engine is intended to work—from two to four miles an hour. There is a blower in the smoke-box. The man-hole is in the smoke-box tube plate. There is a warming cock for heating the water in the tank. The *lower* slide bars are of steel. The chimney is of cast-iron, in one casting ¼ in. thick. The ends, top and bottom, of the water-tank are made of cast flanged plates, the wrought-iron sides being bolted directly thereto. The water tank in front of the fire-box contains 69 gallons of water; the tank behind contains 211 gallons. The tanks carry coal and water for a run of 10 miles. We saw "No. 53" marked on the Yudanamutana engine, which evinces great success in the sale of traction-engines, as we believe that the firm took up this branch of their business only three years ago. The price marked on the engine in the Exhibition was £420. On account of the one tried being made with a larger fire-box, double gearing, additional water-tank, &c., this price has been raised to £530.

The traction-engines now making for South Australia are intended to draw a train of about six waggons. Each waggon is strongly built of oak, and is on four wheels, the front wheels being 3 ft. 6 in., the hind wheels 4 ft, 9 in., in diameter. The front wheels can swivel, and there is a light iron coupling between each waggon. At the late trial of this traction-engine the roads were in a yielding, sloppy state, from the effects of the weather; the mud formed a complete lubricating material between the wheels of the engine and the road. At the same time, to prevent any injury to the road-surface, the clips were not applied to the driving wheels; a few spikes only were inserted in the rims. Each waggon, when loaded with large baulks of timber, weighed about five tons. We saw the engine take five waggons up inclines varying from 1 in 12 to 1 in 8, at speeds varying from four miles to about two miles an hour. The engine ran 7 miles in about 2½ hours, and consumed about 3 cwt. of coal. Probably, no traction-engine, of the same weight, has ever accomplished so much. The engine, with its train of four coupled waggons, passed some very sharp corners with great ease. This is one of the great advantages of an engine over a train of horses, as in turning corners only one or two horses are able to pull properly. The hissing of the steam certainly frightened some horses on the road. This is one of the impediments to the more general introduction of traction-engines. We know, however, by our own experience, that horses very soon get accustomed to the whistling of steam. Of course, if horses can be made to stand the firing of guns, there is no reason why they should not be made to stand the noise caused by a blast pipe.

It is well known that the resistance offered by the surface of a common road to the motion of a vehicle, is in a direct ratio to the load; is in an inverse ratio to the diameter of the wheels; while the resistance is almost uninfluenced by the breadth of the wheels. At slow speeds the resistance is almost independent of the velocity of the vehicle. The co-efficient of resistance, however, varies so much with the state of the road (according to Morin, about from 1-13th to about 1-50th of the load), that it would be scarcely possible to estimate, by calculation, the precise tractive power exerted by Mr. Aveling's engine. Suppose we compare the traction-engine to a team of horses; neglecting the power exerted in moving itself, and only taking into account the four loaded cars. Each car weighed with its load about 5 tons, with wheels averaging 4 ft. in diameter, and 4½ in. in tyres. Considering the bad state of the surface, we may take the co-efficient of resistance on the road at 1-20th of the weight; and the four cars weighing together 20 tons, the resistance on a dead level would thus be 1 ton. To this would be added 2 tons for an incline of 1 in 10, making a total of 3 tons for four waggons, on an incline of 1-10th.

Perhaps the most accurate means of learning the available tractive power would be to use a strong dynomometer, similar to the one employed by Mr. Fowler for ascertaining the draught of his six-furrow steam-plough.

We believe that we may congratulate both Mr. Aveling and his customers on the results of the experiments we lately witnessed.

II.

CONDITION OF OUR IRON CLADS.

One fact is worth a bushel of arguments. We copy, from the Naval Intelligence of the *Times*, an account of the condition of the squadron of iron clads just returned to the Channel, after a cruise in search of gales.

"There are various rumours in circulation as to the actual defects of the squadron. Some are to the effect that the injury done is but trifling either to hulls or machinery, while others assert that although the 'Black Prince' represents the *maximum* of defects in the engineering department, yet all have suffered in their hulls, and especially in the rigidity of their armour plating. The plates are said now, in many instances, to be very loose, a result that might naturally be expected from the way in which they are hung on the ship's side, and the weather the ships have gone through since being commissioned. It is not at all improbable that as other ships can be brought forward the officers and crews of our present iron fleet will be turned over to them, and our four iron ships at present afloat—the pioneers of the future—be laid up in ordinary in readiness for an emergency. There are two reasons, each sufficient in itself, to lead us to believe that this course may be followed. It will certainly be necessary to test our ships that carry armour all round, such as the 'Hector,' 'Royal Oak,' and 'Minotaur,' as fully as we have tested our present partially cased fleet, and we may do this with the officers and crews of our iron-cased fleet at Spithead, The second reason is that we cannot afford, with all our proverbial extravagance in naval matters, to continue experimetal cruises with our iron ships at present afloat in search of gales of wind, without increasing the looseness of the plates and otherwise injuring them. The working consequent upon their looseness would result in a compelled removal of the ship's armour and the employment of new plates; for, of course, no one would pretend to argue for a moment that the same tongued and grooved plates could ever again be placed on a ship's side after being once taken off, especially after such a knocking and buffeting about as Admiral Smart's squadron have undergone."

So at last the truth is out. The inefficiency of the "Warrior" system of armour plating, pointed out in the Mechanics' Magazine more than a year ago, is a fact. An explanation of that system, illustrated by a diagram, which appeared in our columns, described by anticipation the inevitable results of fastening ponderous plates on wood backing with through bolts in the following terms :—"The inherent weakness of this fastening will be perceived. The bolt forms a lever, of which the iron skin is the fulcrum, only half-an-inch in width, and the two arms are, one 22½ in., the other, 3 in. long. The enormous weight outside the skin is suspended to the long arm, and supported by the nut screwed on to the short arm. By this arrangement, there is an immense amount of leverage outside the frame and skin of the ship, tending to tear away the armour plate. The bottom strake of armour plates and teak rests upon the recess, the other strakes rest one upon another, but as the ship rolls and pitches, the ponderous plates at the end of the long bolts have a tendency to fall overboard, and put a violent strain on the nuts and skin. By the constant working of the ship, the bolt holes through the teak will become enlarged, and the bolts themselves will be loosened, causing motion and vibration with every movement of the ship throughout the whole body of iron and wood (weighing about 1,500 tons), which constitute the external armour of the 'Warrior.'"

On several occasions we showed the immense importance of this question, and urged the necessity of decisive trials of a plan theoretically wrong, as well as of other plans submitted to the Admiralty, before completing the armour plating of the ships under construction. We proved by figures, unmistakeably, that the armour of every "Warrior" or "Minotaur," would cost about £100,000, and therefore the iron casing of ten ships of these classes involved an expenditure of a million. In vain did we raise our voice. The subject was little understood. The *Times*, the officials, in and out of Parliament, represented the "Warrior" plan as perfection, and ship after ship was hurried on to completion, without pause or hesitation, as if no better plan could be devised.

We are now warned by the *Times* itself that the day of reckoning is at hand. The danger we pointed out, the possibility of which was pertinaciously ignored, is now admitted to be "a result which might naturally be expected from the way in which the plates are hung on to the ship's side."

Here we have an illustration of the apathy of the Admiralty, and the shifts to which its supporters are driven to bolster up a vicious Administration and delude the public. The *Times*, in the statements it publishes to serve the purpose of the moment, systematically relies upon its readers forgetting one week what they read the last.

At the very moment we are called upon by that journal to admire the economical measures which reduce the navy estimates by a million, we are deliberately told that "no one would pretend to deny" that the armour plates of every one of the iron clads built will have to be taken off and replaced by new ones. Here is a confession to a lamentable want of foresight, and almost criminal disregard to repeated warnings. If the House of Commons does not look to this matter in right down earnest, they will fail in their duty. The ramifications of this now acknowledged failure of the "Warrior" armour are wide spread. It applies still more forcibly to wooden iron clads, jeapordizes the turreted ship, and condemns "wooden bottoms." If the sides of the "Warrior" and "Black Prince," of which the rigidity is immensely increased by the iron skin and frames, are in the condition described after a few days "knocking about," in what state will wooden sides be after a similar ordeal? We have had alarming reports of the leaky state of the "La Gloire," whose armour plates, it was stated, would have to be renewed. In comparison with these much stronger built vessels, we may imagine what will be the effect on the hull and top sides of the "Enterprize;" for instance, when tossed on the waves of a stormy sea, encumbered by the top hamper of her fighting-box, with a light draught, and her ends fore and aft, from the nature of the build, liable to be submerged and swept by the billows. The character of her iron top sides, depending on the insecure fastening together of wood and iron, will be put to the proof. With reference to the resisting force of the armour of the "Enterprise," we hope the Admiralty, after the sad experience it has had of the effects of want of rigidity in the "Warrior" section, will have a target made in order to test the value of 4½ in. plates on 18 in. of wood, without the iron support behind, which gives rigidity to, and is the real source of, strength to the "Warrior" sides.

In the debate on the navy estimates, Mr. Cobden, with his usual felicity of application of practical data, which he candidly acknowledged he derived from the information supplied by men of authority, confirmed the view we have long advocated as to the incongruity of the combination of wood and iron, in the construction of iron clad ships of war. Referring to the high authorities, whose opinions might be relied upon, he used these remarkable words—"They have all emphatically declared that not a "vessel ought to be constructed of wood, cased "with iron, because you are thereby putting a "harder and more rigid substance on a softer "and more flexible one, and the foundation will "give way."

It is impossible to condemn in plainer terms the system of "wooden bottom" construction. Like Mr. Cobden, we do not, in the present state of the question, venture to express a decided opinion of our own. We have no bias; we listen to the advocates of wood and iron, and we admit into our columns the arguments on both sides. At the same time we must confess the conclusion which such a man as Mr. Cobden has come to, after weighing the opposite opinions, makes a deep impression on our mind, and we agree with him, Mr. Laird, and a number of experienced naval men and engineers, that it is the duty of Government to pause in their career of naval construction until experiment and actual experience at sea have determined which is the best class of iron-clads.

Obviously the objections to the construction of a ship with iron plates on a foundation of wooden planks and frames, are applicable to fastening iron armour plates on a wooden backing. The force of those objections is exemplified by the disastrous results to the iron clads in their recent cruise. It would follow, then, from practice, as well as theory, that the true principle of strength for iron-cased vessels is rigidity, which can only be attained, in its highest degree of perfection, by a structure composed wholly of iron. The design of such a structure, fulfilling the conditions of a sea-going and an invulnerable ship, is the problem to be solved by the joint labours of the mechanical engineer and naval architect.

Another fact, and the conclusion drawn from it by the shrewd member for Rochdale, deserve to be recorded as having a direct bearing on a charge against the Admiralty, which has been ventilated in this journal. "My noble friend," says Mr. Cobden, "let out a secret a little while "ago I should not have dreamt of attributing "*motives to him*, if he had not corroborated my "suspicions. But I never could understand "why the Admiralty should buy such an enor- "mous quantity of timber—why they should lay "up a store of 112,000 loads, their whole aver- "age consumption yearly not being a third of "that amount. A friend (says Mr. Cobden) "told me last year, that is all done by the people "in the dockyard; the political officials at the "head of the department know nothing about "it;" and then he continues, "at this moment "they are filling the dockyards with timber, "they are filling the quays also. They are so "full, that I believe the Port Admirals can "hardly walk about. And this very superabun- "dance of timber is then urged as a reason "why they should build iron clads (that is of "wood) in the dockyards, instead of having "*wholly iron* vessels built by contract."

We have been reluctant to place any reliance on the charge of complicity among dockyard officials and the Controller's Department, to entrap the country into a renewal of the construction of a wooden navy; but when we find a member of Parliament, of undoubted prudence and sagacity, plainly insinuating the existence of such a design, we must admit it is not devoid of probability.

Since the above was written, a notice has appeared in the *Times* to the effect that "the "rumours relative to an alleged looseness of "the armour plates of the iron ships had much "exaggerated" the real state of the case. This modification is made in such loose and vague terms, it by no means amounts to a contradiction of the main fact—the looseness of the armour. "So far as can be superficially seen," continues the *Times*, "the 'Warrior' maintains her "pre-eminence, in the general condition of her "hull and machinery. *Here there is no sign* of "loose plates." But what have the hull and machinery to do with the armour plates and teak backing, which are outside the hull, and may be, as no doubt they are, in the most rickety state, notwithstanding the admirable condition of the hull and machinery? The total absence of displacement or strain of any of the *internal* parts, proves the immense advantage of rigidity resulting from the cohesive strength of an iron structure, and its superiority over a wooden one, in resisting the buffeting of the waves. But the defects in the armour plating are another matter on which the *Times* retracts nothing it said the preceding day, and prudently observes, "whe- "ther any defects of this kind exist or not can "only be ascertained when the ships are placed "in dock." To these conclusions we do not demur, but, from our own sources of information, we believe the looseness of the armour plates is to the full extent as great as represented in the first report of the *Times*.

IMPROVED RAILWAY BRAKE.

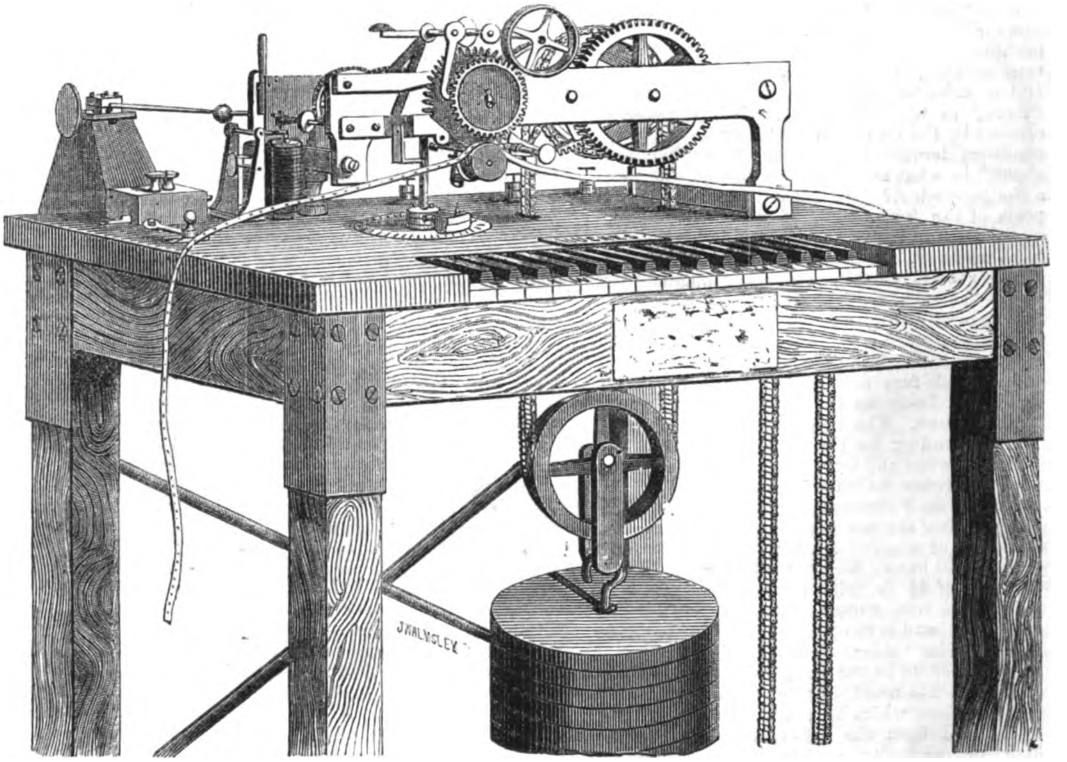
AT the meeting of the Royal Scottish Society of Arts, on Monday night, Mr. Robert Aytoun read a supplementary paper on his proposed railway brake, and the modifications suggested by the report of the committee of the Society. The brake was described in a paper read on the 8th Dec. last, and the report of the committee upon it was read and approved of at the last meeting of the society. The principal objection of the committee to the proposed brake was that the hold or grip which it took of the mid-rail was so powerful that it could tear up the road, and throw everything into confusion; but as the brake proceeded upon friction alone, just as in the case of the present system of brakes, the only difference being that he was able by means of the springs and the mid-rail to put on as much friction as might be necessary to bring up a train within a reasonable distance, while by the present system they were prevented from getting friction beyond that which was due to the weight of the tender and break-van. In the ordinary system, brakes would be applied to the wheels of the tender weighing 6 tons, and to the wheels of the brake-van weighing 4 tons, and, supposing every wheel in these two carriages acting as a sledge, the friction in that case would be 2½ tons, which would bring a train to a stand in 400 yards. In his plan he proposed, by means of springs pressing upon the mid-rail, to bring a friction of 10 tons as a drag upon the train, which would bring it to a stand in 100 yards. In deference to the opinions expressed by the committee he proposed two modifications on his plan—first, to have two spring brakes, each of half the power originally proposed for the single brake—these to be placed in the tender and van respectively; and, 2nd, to cover with iron plates the wooden mid-rail for 100 yards on either side of each station, which were the only parts of the mid-rail that would be liable to wear and tear. On the question of cost, it was objected by the committee that it would require £3,000,000 to apply this plan to the 10,000 miles of railway now open in this country; but he submitted that, while many millions had been squandered on useless railway schemes, £3,000,000 was not too great a price to pay for rendering safe 10,000 miles of railway. Mr. Aytoun concluded by saying that since the paper was written he had had the advantage of reading the evidence of Neil, the surviving engine-driver, on the Winchburgh collision. His evidence put in a striking point of view the miserable insufficiency of the present system of brakes. He saw the opposite train at a distance of three-quarters of a mile, which distance was much more than sufficient to check both trains without collision, even by the existing brakes, had there been means, as there always should be, of applying their full force instantaneously by drawing a trigger and releasing them from a catch. Not having such means at his disposal, he sounded the whistle to alarm the guards and to tell the firemen to go to the brake; he then went to the other brake of the tender himself, and put it on; he then reversed the engine; and, lastly, jumped off. The process of screwing the breaks is a tedius one, and takes up more time than they had at their disposal, which was only one minute and a-half. But suppose they managed to screw it home, and to lock the wheels, this could only have been attained after the collision was inevitable. He went on to show that there would have been no collision in this case had means existed of instantaneously applying the full force of the breaks of the tenders of the two trains at the moment when they became visible to each other, and concluded by remarking that until he read the evidence of Neil he had no idea that the collision could have been entirely prevented by so simple an expedient as he had suggested.

Mr. Sang, C.E., said that at present the only means of stopping a train was to take advantage of the friction of the wheels on the upper side of the rail, which it was well known could only be a limited source of resistance; because to bring out the full resistance to be obtained in this way it was necessary to lock every wheel of the train. Mr. Aytoun had adopted the only other expedient possible, of creating a pressure on the two sides of the rails. The proposed plan, however, would be impossible to work, because whenever there was a crossing it would be necessary to interrupt this mode of stopping a train; this rod could not be laid where two rails crossed each other. It was a serious objection, that this powerful and effective way of stopping a train was not practicable at the crossing of two lines, or at a junction, where of all places the means of stopping a train was required. This difficulty did not belong to Mr. Aytoun's plan alone, but to all plans which proposed to take advantage of side pressure.

Mr. Bouch, C.E., thought that Mr. Aytoun's plan was not so good as that which the same gentleman proposed some time ago. After some strictures on the plan, he concluded by saying that at present they are applying steam brakes to the wheels of the engine itself. This plan was coming into use on many of the English lines, and he thought it was a very effective one, and one which should be generally adopted by railway companies.

Mr. Sang remarked that there are frequent complaints on the part of the public that trains going at the rate of twenty miles an hour do not go fast enough. When a train was going at sixty miles an hour, however, it should be understood that the velocity was equal to what it would be if the train was placed on the top of the steeple of St. Andrew's Church, and the supports being knocked away, it fell to the ground. Engineers were at present devising the best means to break such a fall, by trying to discover the most powerful brake to arrest a train going at the rate of sixty miles an hour.

PROFESSOR HUGHES' TELEGRAPHIC TYPE PRINTING INSTRUMENT.



PROFESSOR HUGHES' TELEGRAPHIC TYPE PRINTING INSTRUMENT.

The apparatus for printing by the aid of electricity, which we illustrate in the annexed engraving, was invented and patented in this country by Prof. Hughes. We find that, after many futile attempts to introduce it into practical use in this kingdom, the invention was applied in America, where it achieved great success, and, after working successfully in France and Italy, the apparatus has found its way back to England. The United Kingdom Telegraph Company have adopted it, and secured the right from the inventor to grant licenses for its use in this country. There can be no question as to the efficiency of the instrument. Mr. Bright's speech at Birmingham, on the 15th of January, was transmitted by the instrument at greater speed than the reporter could supply "copy" from his notes.

The principle upon which the apparatus is based is that of a synchronous movement of clockwork trains, driven by weights, and separated long or short distances apart, moving independently of one another; the regulation is effected by vibrating rods. But as absolute synchronism is unattainable, the object of the inventor has been to introduce a correction sent by the one apparatus to the other apparatus at the distant point, the instruments thus becoming their own correctors of any fractional differences of speed, and preventing their accumulation. The electrical waves are transmitted by a revolving arm, carrying the segment of a circle as a contact-maker, and the arm revolves at the same speed in each apparatus as the type-wheel; when a key is pressed a metal plate in connection with the battery is forced upwards, and meets the contact-maker as it revolves, scrapes along its surface, the current passing the while, and is then thrown back by the contact-maker, and brought to its normal potition of rest by a constant spring. The letters are printed while the type-wheel is in revolution, and the type-wheel is driven by friction, which allows of its being moved backwards or forwards by mechanical means. Each apparatus registers the signals sent by it, and all letters are produced at the distant end by a single wave of electricity. This wave of electricity performs but one duty, that of releasing a soft iron armature retained in contact by a pair of induced electro-magnets, the wave tending to produce magnetism of an opposite polarity to that of the magnetism induced. A very slight disturbance of the attractive force of the induced magnetism is sufficient to release the armature, which is constantly pressed against by a spring; the electrical apparatus is therefore very sensitive, and being acted upon at the contact point, or most favourable position of the metals, exercises a maximum force. The armature, in springing up, releases the printing machinery, and a letter is produced. The train is stopped or set in motion in the ordinary way. When the apparatus at both ends are started, a ball revolving with the vibrating rod geared to the train, is advanced or drawn back, so as to describe a larger or smaller circle, as it is desired to drive at lesser or greater speed. Any variation in speed is detected as follows:—At one end, say Birmingham, the operator sends blanks, by touching his key corresponding to the blanks on the type-wheel, if London prints A, then B, and so on, the apparatus at London is running too fast, and he advances a ball; if he receives Z, then Y, and so on, his apparatus is running too slowly, and he draws the ball back, until his apparatus also makes but blanks, when both are ready to communicate.

Blanks may be struck at every revolution, or at every five, or ten, or more, thus testing the synchronism more severely. In the face of the instrument there are 28 keys, arranged like the keys of a piano; these 28 keys correspond with 28 metal pieces or plates, working upwards through slots formed all round a circular disc of metal, on the top of which, but not in connection with it, the arm and contact-maker revolve. The type-wheel and this arm revolve together, and when a key is depressed, a plate corresponding with the letter touched is raised; the position of this on the disc is such, that at the moment the arm and contact-maker touch the plate in their revolution, the corresponding letter on the type-wheel is over the printing roller, at Birmingham and at London; the current instantaneously passing releases the printing gear at both places, disengaging a detent, a cam driven by the clockwork train immediately presses the paper against the type wheel, and a letter is printed whilst at the same instant, by a graduated movement, the paper is carried on a space ready to receive the next impression. At the same instant that the letter is printed, a cam, also driven by the train, is forced up into deep grooves in a wheel in each apparatus, corresponding with the type-wheel in such a manner that, if either instrument tend to advance, it is checked; or if the tendency be to fall in arrear, it is forced forward. This takes place with every signal sent, so that at each signal the type-wheels are, so to say, connected with one another. It will thus be seen that at each depression of the key a wave of electricity is sent, a letter printed, and the speeds of the apparatus are corrected.

SUCCESSFUL EXPERIMENTS WITH PROJECTILES.

Late experiments with the famous Stafford projectile and sub-calibre shell, says the *Scientific American*, show that it is one of the most formidable weapons of its class. In Washington, on Monday, Jan. 26, 1863, a shell weighing 86 lbs. was fired from a 150-pounder Dahlgren rifle, with a charge of 15 lbs. of powder, at a range of about 50 yards, into a target representing a section of the "Warrior's" broadside. The shell exploded in the target, between the plating and timber braces, and blew the same to fragments. Also, a shot weighing 108 lbs. was fired at the same target, at the same range, and went completely through and buried itself five feet in the bank behind. The wood and iron of the target were driven before the shot, which made a very ragged hole, and flew in all directions. Previous experiments with these projectiles proved conclusively that targets of 9-inch iron plates, backed by 21 inches of hard wood, can be readily penetrated when fired from a Dahlgren gun. Indeed, the inventor of this shot thinks that the Dahlgren gun is one of the best in the country; a great many of his experiments have been conducted with it; and he is satisfied to endorse its virtues as a national arm. Experiments were also made at West Point with the Stafford projectile, at which the most favourable results were obtained. We have before us an official report of them, signed by Captain Benet, of the Ordnance Department, in which their good qualities are set forth. Angulated targets, nine inches in thickness, it is said, can be penetrated with ease.

The *Telegrafo* of Barcelona gives a strange account of an apparatus for flying in the air, invented by a farm labourer named Orujo, residing near Malaga. It consists of fans attached to the heels, and large wings extending from the shoulders to the waist, and moved by the hands. The inventor, the above-named journal states, had already risen to a height of 200 yards, and moved about in all directions, even against the wind. He had also performed the distance of a league in less than a quarter of an hour. This reads something like a bit of Yankee invention.

The Association of the Chambers of Commerce, which held its annual meeting at Palace-yard, Westminster, this week, considered, among other things, the patent laws and the metrical system.

HUNT AND CO.'S MACHINE FOR CUTTING BEVEL WHEELS.

F.C.I.

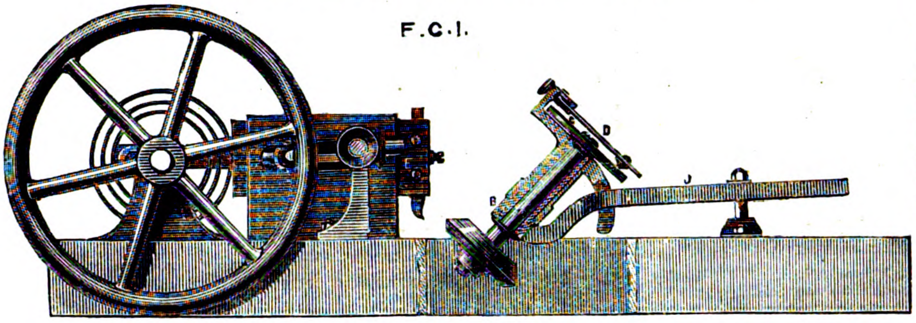
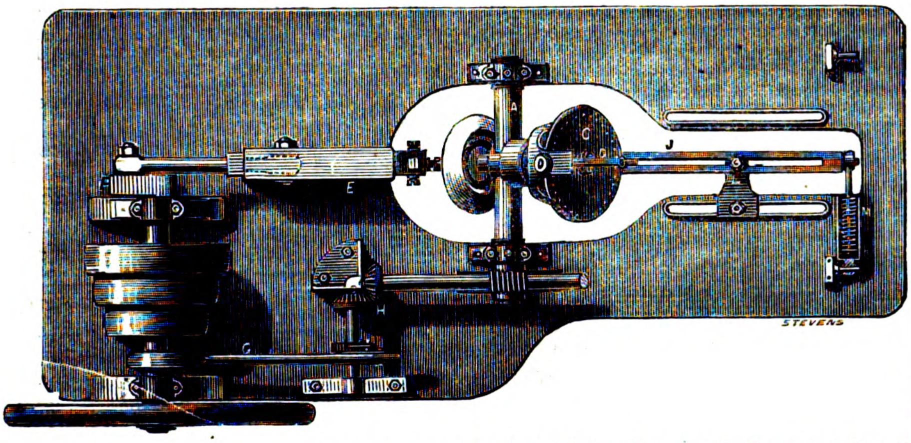


FIG. 2.



HUNT'S MACHINE FOR CUTTING BEVEL WHEELS.

In a late number we alluded at some length to machines for shaping the teeth of wheels. The following is a detailed account of the ingenious machine for cutting bevel wheels that was exhibited in the western annex of the International Exhibition, by Messrs. Hunt and Co., Bow.

Fig. 1 of the annexed engravings represent a partial side view of the apparatus; and Fig 2 a plan of the same. Upon the bed plate, and supported by means of plummer blocks, is a cross shaft A, which carries a metal piece or socket B, through which a spindle passes. To this spindle the bevel wheel to be operated on is fixed. The upper part of the spindle has also fixed to it a division plate C, on the surface of which a number of small holes are made, and into which holes a pin on the end of the spring arm D enters, to hold the wheel rigid while being cut. The tool holder E is held in a traversing carriage on the bed plate, and caused to travel to and fro by means of a crank F, driven in the manner shown in the engraving. The crank shaft is furnished with an eccentric and rod, and which actuate a paul and ratchet wheel, in connection with bevel gearing H, and worm wheel for regulating the movement of the cross shaft A during the cutting operation. When one side of a tooth of a wheel has been cut the worm wheel is thrown out of gear. The lever J is moved sideways till the tool P *a* arrives in the middle of the space between the cogs or mould to be cut, when the lever J is raised that the wheel may be clear of the tool when the division point is released, and the division plate moved to the next division, and so proceeds until one side of each cog is finished: the tool is then withdrawn, and replaced by another, with the cutting edge on the opposite or reverse side. Before commencing cutting the opposite side of the wheel, the guide cog or pin and the steel edge L, must be moved to the other side, and the spiral spring M fixed on the other bracket; the wheel is then adjusted by turning a thumbscrew; the side of the cog to be cut is brought in a line with the tool, when it is continued, as in the first instance. When this part of the operation is finished, the portion of the wheel which has been used for supporting it on the spindle arbor is cut off by means of turning. The spaces in the cogs of the bevel wheels or pinions are formed or shaped to the cycloidal curve, or varied according to the pattern which may be preferred, as regulated by the shape of the guide piece.

ON THE PURIFICATION OF COKE.

By M. E. Kopp.

Though in very many cases coal and coke are already substituted for wood and charcoal, there are, neverthelsss, certain metallurgic operations for which charcoal is still used, through fear of the impurities of the coke injuring the quality of the product. We need only cite as instances the blast furnaces, furnishing cast-iron with wood or charcoal, the fining of iron by charcoal, the preparation of what is called German shear-steel, by fining steely cast-iron, &c., with wood-charcoal. If, on the one hand, coke could be deprived of all its injurious components, such as sulphur, phosphorous, and the large proportion of earthy matters, and, on the other hand, if all the useful matters in which it is deficient could be added to it, such as carbonates, and alkaline chlorides and silicates, there can be no doubt that, thus purified and modified, it would in nearly every instance economically replace charcoal.

Innumerable methods of purifying and ameliorating coke have already been proposed; but some are almost inoperative, others too expensive, and others again would rapidly destroy the coke furnace. M. Scheerer (*Berg-w. Huttenm.*, Zeit., 1854, No. 29) passes a current of water vapour through the furnace of red-hot coke, thus reducing the proportion of sulphur from 1·1 per cent. to 0·4 per cent. M. Bleibken damps the coal previously with milk of chalk or lime (*Dingl. Journ.*, vol. cxlvii., p. 295), and so produces limed coke. MM. Claridge and Roper (*Rep. of Patent Inv.*, November, 1858, p. 375) also use water vapour, superheated (which seems useless in presence of coke, at almost white heat); others mix sea salt with the coal, or add it to the coke when incandescent in the furnace and others advise the employment of fluoride of calcium, &c.

It is now some years since, in 1856 (On the Continuous Preparation of Lighting and Heating Gas), that we proposed to purify coke by very weak hydrochloric acid, and the addition of a little carbonate of soda to the coke, purified, washed, and dried.

This weak acid is generally rejected, and turned off as waste, but it is just this waste which could be admirably utilised for the purification of coke.

The process is simple enough. After the conversion of coal into coke in the usual way, the coke is taken red-hot from the furnace. In well-constructed coke furnaces this is effected mechanically; the furnace is open at each extremity, and a very thick, shield-shaped plate of cast iron, adjusted to a strong toothed rod of iron, which is propelled with great force by gears, gradually pushes before it, and finally expels from the furnace, in a single block, the whole of the prepared coke. The incandescent coke is generally extinguished by throwing a large quantity of water over it. This water we propose to acidulate with hydrochloric acid; or, simpler and better still, to let the incandescent coke fall into a reservoir, containing the slightly acid water flowing from the second condensing tower.

The incandescent coke may contain protosulphide of iron, proceeding from the pyrites, which, at red heat, have lost half their sulphur, sulphide of calcium proceeding from the reduction of sulphate of lime, phosphates, silicates, &c. By contact with the diluted hydrochloric acid, the sulphides of iron and calcium are transformed into chlorides of iron and calcium, with disengagement of sulphurreted hydrogen, which is carried away by the water vapours, escaping abundantly when the coke is extinguished. The phosphates are converted into soluble biphosphates, and even the silicates may be attacked; the bases dissolve, as chlorides, a portion of the silica at the same time becoming soluble, which happens when a silicate is digested, hot, in a very diluted acid. Were the coke only sprinkled with hydrochloric water, and allowed to dry immediately from the heat retained in it, even when the burning had ceased, the chlorides, biphosphates, and silica would remain; but certainly the sulphuretted hydrogen, and with it nearly all the sulphur, would have been eliminated. But, on the contrary, if the coke were impregnated with acid solution, and were then washed with water, a large portion of the impurities specified would be expelled by the washing. The washed coke can then be dried, either in the air, or by the unutilised heat of the coke kilns. To impart to it still more the qualities of charcoal, it may be sprinkled with a weak solution, or powdered over with dry carbonate of soda, as free as possible from sulphate, about a few milliėmes the weight of dry coke being sufficient.

The carbonate of soda, prepared by means of kryolite (double fluoride of aluminium and sodium), naturally containing no trace of sulphate, answers best for this purpose.

In most instances finely powdered kryolite may be used with advantage, and one-third to one-half per cent. added to the coke. Kryolite supplies economically the alkali which the coke lacks; and though the soda exists in this mineral in the state of fluoride, there seems no doubt as to its beneficial influence.

We have had occasion to make several trials in fusing cast-iron and steel with coke purified by weak hydrochloric acid, with addition of a little carbonate of soda, and the results were decidedly favourable, as compared with those obtained with ordinary unprepared coke.

Finally, we think that a series of experiments should be undertaken, to ascertain what effect kryolite used in blast furnaces would have on the yield and the quality of cast-iron, and in puddling furnaces on the properties of puddled steel. Kryolite is found in very large masses in Greenland, and the price will decrease as the applications of it become more numerous.—*Repertoire de Chimie pure et Appliquee.*

IRON-CLAD SHIPS.

BY CAPTAIN C. P. COLES.

THE present transition state of navies, and the great progress which has been made in the construction of large guns, especially in America,* leave but little doubt that we are as certain to pass from 68-pounders to 300-pounders, as we were from 32-pounders to 68-pounders when iron-clad ships became a matter of necessity; these convictions have induced me to print the following tables and calculations, showing the relative cost of constructing and maintaining a fleet of iron-clad ships with broadside ports that cannot carry these guns, and shield ships that would carry them. The comparative destructive powers of these vessels must be computed from the actual weight of broadside thrown from guns protected by armour plates: and to make this comparison as clear as possible, I have separately compared the "Prince Albert" shield ship with four different classes of iron-clad vessels with broadside ports. An examination of the following table (A) will enable some conclusion to be arrived at as to the comparative cost, tonnage, and fighting powers of shield ships and ships with broadside ports.

In comparing the destructive powers of these ships's broadsides, it has to be remembered that the mere weight of metal, if taken alone, would convey but a small idea of the effect they would produce; as a few heavy projectiles from large guns might destroy a ship which would receive little or no injury from a broadside of the same weight of metal, made up of a number of shot of a smaller nature. But setting aside the great advantages of heavy shot, it is now known that shells, under favourable circumstances, can be made to penetrate iron plates 4½ in. and 5½ in. thick. These shells, to be effective, must contain large bursting charges, and be of great size and weight—two conditions which necessitate the employment of guns too heavy to be used in ships with broadside ports.

Taking the comparative costs of the vessels, stated as in table A, a reference to the accompanying table B will give a very correct idea of the great saving of expense that would have resulted from the application of the shield principle to the ships now built or building, a saving which may be stated at nearly £3,000,000, viz.:—

In construction . . .	£1,853,566
6,954 men being required, at £48 each = £333,792 per annum, representing a capital of .	£953,600
Total . .	£2,807,166

Apart from the above considerations, a matter of even greater importance is at issue. The great draught of water of these enormous and unwieldy ships with broadside ports, render it indispensable that our docks and basins should be reconstructed to receive them. They are, for the same reasons, rendered incapable of entering many of the foreign ports, or approaching, if needs be, within an effective distance of an enemy's coast; whereas with the light draught of water, and the smaller dimensions of shield ships, no such objections present themselves. For such ships, the existing docks in our Government establishments are large enough; and in time of war those of our merchant yards would be available, if required.

TABLE "A."—Showing the comparative Cost, Tonnage, and Fighting Powers of Shield Ships and Ships with Broadside Ports.

NAME.	If partially or wholly Cased.	Thickness of Armour Plating.	Length.	Draught of Water.	No. of Men.	Guns in One Broadside protected by Armour.	Weight of One Broadside in lbs. thrown from Guns protected by Armour.	Tonnage.	Cost at £62 4s. pr Ton for Shield Ships, and £58 4s. per Ton for Broadside Port Ships.	Speed.
		inches	feet.	ft. in.			lb.			knots.
Defence, (Guns in Broadside Ports.)	Partially	4½	280	25 6	455	5 68 Prs. 2 110 Prs.	560	3720	£226,504	11·3
Prince Albert. (Guns in Revolving Shields)	Wholly	5½	240	20 0	160	3 300 Prs. 2 110 Prs.	1120	2529* 2679†	£157,303 £166,663	11·4
Valiant. (Guns in Broadside Ports.)	Partially	4½	280	25 2	600	12 68 Prs. 3 110 Prs.	1146	4063	£236,466	11·7
Prince Albert. (Guns in Revolving Shields)	Wholly	5½	240	20 0	160	3 300 Prs. 2 110 Prs.	1120	2679	£166,663	11·4
Warrior. (Guns in Broadside Ports.)	Partially	4½	380	26 2	704	13 68 Prs.	884	6109	£355,543	14·3
Prince Albert. (Guns in Revolving Shields)	Wholly	5½	240	20 0	160	3 300 Prs. 2 110 Prs.	1120	2679	£166,663	11·4
Favorite. (Guns in Broadside Ports.)	Partially¶	4½	225	21 11	160	2 68 Prs. 2 110 Prs.	356	2186	£127,225	10·8
Prince Albert. (Guns in Revolving Shields)	Wholly	5½	240	20 0	160	3 300 Prs. 2 110 Prs.	1120	2679	£166,663	11·4
Royal Sovereign.‡ Converting into Shield Ship	Wholly	5½	240	23 9	200	5 300 Prs.	1500	3963	—	12·2

* Without masts, as at present.

† Extra tonnage required, had she been built for a sea-going ship with masts, according to my view, which would be the case with all ships built for foreign service; a duty for which shield ships are peculiarly adapted.

‡ This Ship being a conversion of a Line-of-Battle Ship into a Floating Battery, no correct comparison of expense can be established between her and other Ships. Her deck will be covered with inch iron, being double the thickness of any other ship's deck.

¶ This is taken from the Parliamentary return called for by Mr. Laird, 21st July, 1862; some modification I believe has since been made.

TABLE "B."—Showing the comparative No. of Men, Draught of Water, Tonnage, and Expense of Ships throwing the same Weight of Broadside from Guns protected by Armour, on the Broadside Port system and the Shield system.

	Armour-plated Ships with Broadside Ports afloat and building.								Armour-plated Ships throwing an equal weight of Broadside if built on the Shield principle.					
NAME.	If cased partially or wholly.	Draught of Water.	No. of Men.	Guns in one Broadside.	Weight of one Broadside in lbs. from Guns protected by Armour.	Tonnage.	Cost at £58 4s. per Ton, including Engines.		Draught of Water approximately.	No. of Men required.	Weight of one Broadside in lbs. from Guns protected by Armour.	Tonnage.	Cost at £62 4s. per Ton, including Engines and Shields.	
		ft. in.			lbs.	tons	£	s.	feet.		lbs.	tons	£	s.
Achilles …………	Wholly	26 9½	704	13 68prs	884	6079	353,797	16	20	120	884	2121	139,926	4
Agincourt ………	,,	26 2	704	13 68prs 4 110prs	1324	6621	385,342	4	22	200	1322	3272	203,518	4
Minotaur ………	,,	26 2	704	,,	1322	6621	385,342	4	22	200	1322	3272	203,518	4
Northumberland	,,	26 2	704	,,	1324	6621	385,342	4	22	200	1322	3272	203,518	4
Black Prince……	Partially	27 0	704	13 68prs	884	6109	355,543	16	20	120	884	2121	139,926	4
Warrior …………	,,	26 2	704	,,	884	6109	355,543	16	20	120	884	2121	139,926	4
Hector …………	,,	25 2	600	12 68prs 3 110prs	1146	4063	336,466	12	21	160	1146	2750	171,050	0
Valiant …………	,,	25 2	600	,,	1146	4063	336,466	12	21	160	1146	2750	171,050	0
Prince Consort …	Wholly	26 7	600	12 68prs 4 110prs	1256	4045	235,419	0	22	200	1256	3114	193,690	16
Caledonia ………	,,	26 7	600	,,	1256	4045	235,419	0	22	200	1256	3114	193,690	16
Ocean ……………	,,	26 7	600	,,	1256	4045	235,419	0	22	200	1256	3114	193,690	16
Royal Alfred……	,,	26 7	600	,,	1256	4045	235,419	0	22	200	1256	3114	193,690	16
Royal Oak………	,,	26 7	600	,,	1256	4045	235,419	0	22	200	1256	3114	193,690	16
Defence …………	Partially	25 6	455	5 68prs 2 110prs	560	3720	216,504	0	19	100	560	1344	83,596	16
Resistance………	,,	25 6	455	,,	560	3710	215,922	0	19	100	560	1344	83,596	16
Favorite…………	,,	21 11	160	2 68prs 2 110prs	356	2186	127,225	4	18	80	356	864	53,740	16
Enterprise………	,,	15 6	80	2 110prs	220	990	57,618	0	15	60	220	528	32,821	12
TOTALS	—	—	9574	—	16,892	77,117	4,688,209	8	—	2620	16,886	41,329	2,594,643	4

General Dimensions, &c., of "Prince Albert," Shield Ship, building.

NAME.	If partially or wholly clad.	Thickness of Armour Plating.	Length.	Draught of Water.	No. of Men.	Guns in one Broadsids protected by Armour.	Weight of one Broadside in lbs. thrown by Guns protected by Armour.	Tonnage,	Cost at £64 4s. per Ton, including Shields and Engines.	Speed.
		inches.	feet.	feet.			lbs.	tons.		knots.
Prince Albert ………… (Guns in revolving shields.)	Wholly	5½	240	20	160	3 300prs 2 110prs	1120	2529* 2679†	£157,303 £166,663	11·4

* Without Masts, as at present.

† Extra tonnage required, had she been built for a sea-going Ship with Masts according to my view, which would be the case wiih all Ships built for foreign service, a duty for which Shield Ships are peculiarly adapted.

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* The following extract is from a letter, dated New York, Jan. 20, 1863, and is of undoubted authority:—"The number of 15-in. guns already cast and mounted is 34. The foundry at Pittsburgh is turning out three a week, the foundry at Providence one a week, and the foundry at Boston two a week; making an actual production of one 15-in. gun a day. These guns fire a solid round shot of 450 pounds weight, and a shell of 370 pounds weight, containing 17 lbs. of powder. The charge of powder in the gun is from 40 lbs. to 50 lbs., and you can easily imagine the effect to be terrific. With this gun we do not aim so much at penetrating as crushing; and the idea is, that the sides of one of your iron-plated ships would be entirely broken by shots of such enormous weight, moving with an initial velocity of 1,400 ft. per second, a rate which we have reached with recent trials at the Washington Navy Yard."

ARTIFICIAL ILLUMINATION.

Dr. Frankland delivered a lecture on "Artificial Illumination," at the Royal Institution of Great Britain, on Friday evening, Feb. 13. He commenced by stating that it was ten years since he delivered a lecture on the same subject at the Royal Institution. In the interval very little improvement had taken place in the means of producing artificial light; but recently a new illuminating agent had been introduced, and the magneto-electric light had received an important application. The lecturer exhibited and described the electric light; and went on to speak of Dr. Faraday's discovery of the magneto-electric spark, and its application to lighthouse illumination. Professor Holmes' machine, he said, had been in operation at the South Foreland lighthouse for twelve months without break or failure. The electric light, however, was of no use for domestic purposes; its cost was too great, and it was only available where light of the greatest intensity was required. Some improvements, in the form of mechanical contrivances for keeping the carbon poles at proper distances, have been introduced, as instanced in the clock-work arrangement in Duboscq's lamp; and the electric light had received a modification in the substitution by Mr. Way of mercury for the carbon poles. The light emitted from the mercury poles Dr. Frankland showed to be far inferior to that emitted from the carbon points. He stated that it only amounted to one-twentieth: but the battery used was not the best adapted to procure a good light, as it required quantity rather than intensity.

In gas manufacture very little improvement had been made in these ten years. Sulphur was still found in it in considerable and, perhaps, undiminished quantity. It was present in the form of bisulphide of carbon, which was irremovable by the ordinary modes of purification. A method, however, had been devised by the Rev. — Bowditch, the Vicar of Wakefield, by which almost all could be easily got rid of. It consisted in passing the gas over hydrate of lime heated to 400 degs.; by this means the sulphur of the bisulphide of carbon was brought into the form of sulphuretted hydrogen, which was removed by the ordinary oxide of iron purifyer. On the small scale, this process was found to take away nearly all the sulphur, and it might, perhaps, answer as well on the large. The lecturer stated that he had never found more than nine or ten grains of sulphur in 100 cubic feet of gas, but he was aware that others had found as much as 40 or 50; and he believed the quantity commonly present was about 20 grains in the 100 cubic feet. Recently, a new illuminating constituent, acetylene, had been discovered in coal gas, and the discovery may, perhaps, entirely revolutionise the manufacture. At present, a comparatively low temperature is employed in the manufacture of gas; but an intense heat is favourable to the production of acetylene. It is produced when carbonic oxide and carburetted hydrogen are strongly heated together. It would be necessary, the lecturer said, to investigate how this body could be produced on a large scale to increase the illuminating power of gas; but the subject was still *in embryo*. Acetylene may be obtained from gas by passing it through a solution of subchloride of copper, by which means what might be called an acetylide of copper was produced, in the form of a brick red precipitate. The lecturer showed that this acetylide of copper was decomposed on the addition of dilute hydrochloric acid, and that the acetylene evolved burnt with a brilliant flame. The acetylide of copper is an explosive compound, which has been the cause of several accidents where gas has been passed continuously through copper tubes. It is exploded by friction, percussion, and by heat.

The use of animal and vegetable oils for illuminating purposes had received no new development the past ten years; but a new source of light of the greatest importance has been distilled by Nature herself. The native oil of the United States and Canada is obtained in immense quantities; from the latter country alone as much as 20,000,000 of gallons have been procured, which, it has been calculated, would give as much light as 180,000,000 of pounds of sperm candles. The importance of these oils could not be overrated. Some accidents had resulted from their use, apparently from careless manufacture, it being necessary to remove the lighter constituent oils before they could be used with perfect safety. The lecturer explained that it was necessary to burn these oils, as well as Young's paraffin oil, in lamps made of some badly-conducting material like glass, so that the oil in the reservoir might not become heated; and he showed the explosiveness of some oils, and non-explosiveness of others, when heated to 120 degs.

The following diagram exhibits the illuminating equivalents of various materials, showing the quantities of other substances required to give the same amount of light as would be obtained from one gallon of Young's paraffin oil:—

Young's paraffin oil	...	1·00	gallon.
American rock oil (1)	...	1·26	„
„ „ (2)	...	1·30	„
Paraffin candles ...	...	18·6	pounds.
Sperm „ ...	...	22·9	„
Wax „ ...	...	26·4	„
Stearic „ ...	...	27·6	„
Composite „ ...	...	29·5	„
Tallow „ ...	...	39·0	„

The comparative cost of light was shown in a diagram exhibiting the compatitive cost of the light of twenty sperm candles, each burning ten hours, at the rate of 120 grains per hour:—

		s.	d.
Wax ...	... ...	7	2½
Spermaceti	... ...	6	8
Tallow ...	... ...	2	8
Sperm oil	... ...	1	10
Coal gas ...	... ...	0	4½
Cannel gas	... ...	0	3
Paraffin candles ...	... ...	3	10
„ oil	... ...	0	6
Rock oil ...	... ...	0	7½

It was thus shown that paraffin and rock oils are the best sources of light for domestic purposes, inasmuch as they give the largest amount of light with the least development of heat.

Amount of carbonic acid generated, and heat evolved per hour, in obtaining a light equal to twenty sperm candles, each burning 120 grains an hour:—

		Carbonic acid in cubic feet.		Units of heat.
Tallow	...	10·1	...	100
Wax Spermaceti	...	8·3	...	82
Paraffin	...	6·7	...	66
Coal gas	...	5·0	...	47
Cannel gas	...	4·0	...	32
Parafin oil Rock „	...	3·0	...	29

The lecturer then entered upon the chemical and physical principles concerned in the production of light, explaining that it was produced by the incandescence of certain solids or vapours. The incandescence of liquids is never used, and in one case only—the mercurial light—is a vapour employed. In all other cases it is the incandescence of solid carbon. He explained, too, how the light was effected by the pressure of the atmosphere and temperature; a great pressure of the atmosphere brought more solid particles to incandescence, and a fall of one inch in the barometer involved a reduction in illuminating power of 5 per cent. When the air supplied to the burner, or the gas itself is heated, an increased illumination is obtained with the same consumption of gas, amounting to 62 per cent.; or, for an equal amount of light, the saving of gas would amount to 83 per cent.

Mr. Frankland then explained the conditions of a good light, and showed that it was necessary that light for ordinary purposes should contain all the colours of the spectrum, as the light obtained in all common modes does. He showed the effects of the monochromatic light of sodium on colours. Solar light, he stated, was defective in showing colour, as it was incapable of showing tints brought out by sodium, and that, consequently, a pigment containing these tints would be invisible by daylight. Sunlight passed through a variety of vapours, of which sodium was one, and the lecturer showed how the sodium band in the spectrum was obscured when the light passed through the incandescent vapour of sodium. Solar light, however, had one great advantage over that from all other sources, inasmuch as it was attended with less heat, and, consequently, ordinary daylight produced less discomfort in the eye than any artificial light.

The disadvantage of having heat associated with light was, that the greater part of it was absorbed by the humours of the eye, there causing pain and discomfort. The behaviour of the eye towards the heat of a moderator lamp had been examined, and the following diagram represented the amount reflected and absorbed by the various media:—

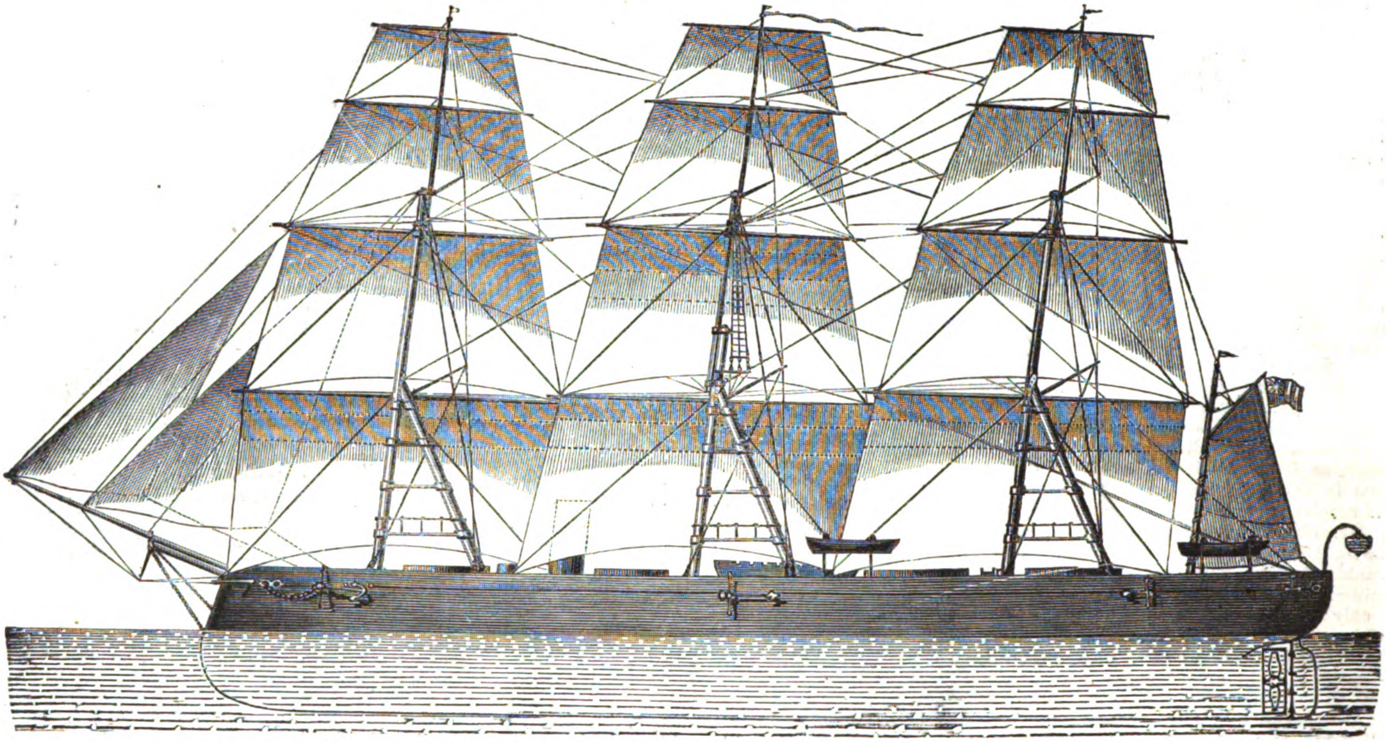
	Eye of ox.	Eye of sheep.	Eye of pig.
Rays reflected at surface of cornea	4	4	4
Rays absorbed by cornea	59·8	56·9	57·5
„ „ aqueous humour	19·2	—	20·6
„ „ crystalline lens	6·8	30·7	7·2
„ „ virtreous lens ...	2·5	—	1·6
Rays which penetrate to retina ...	7·7	8·4	9·1
	100·0	100·0	100.0

In conclusion, Dr. Frankland alluded very briefly to the difficulties in the way of applying the discoveries of science to every-day purposes. It was thirty years ago that Riechenbach first made paraffin and paraffin oil in the laboratory, and twenty years elapsed before any practical use was made of them. It was thirty years since Dr. Faraday showed the magneto-electric spark. How long shall we have to wait for any development of thermo-electricity, or the direct transformation of heat into light by electricity? In the magneto-electric machine the transformation was accomplished by the intermediate transformation of heat into mechanical force, by which there was experienced a loss of nine-tenths of the heat force. The man of science was rewarded by the truths which he discovered; it was not his function to apply these truths to useful purposes. That required quite different powers of mind.

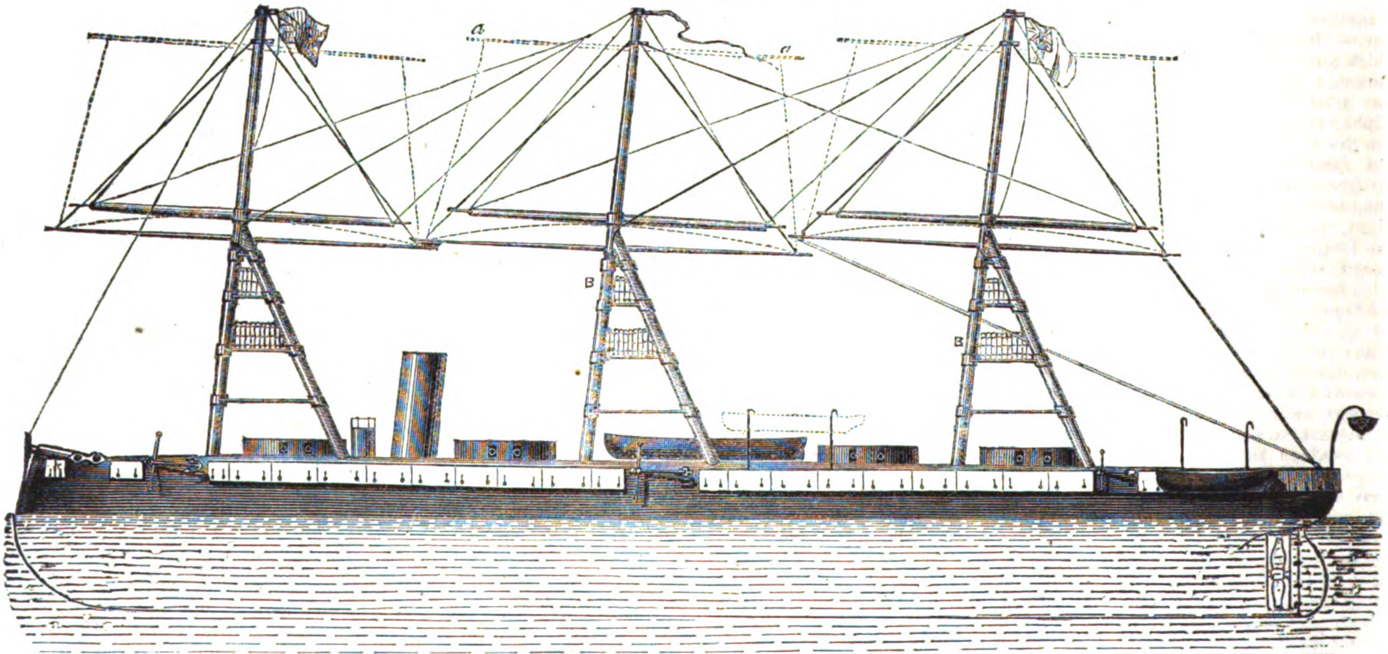
HOW TO USE CALLIPERS.

It may be safely assumed that comparatively few mechanics use callipers properly. There are many different forms of callipers with which all mechanics are familiar, such as those having springs, and those which are secured, when set, by set-screws biting on an arc. While all these have their several merits, commend us after all to the old-fashioned sort made with two legs, two washers, and a good rivet. Now, what is the reason that one man will always make a good fit when turning a shaft to fit a bore, or the reverse, while another man makes a botch of it? The reason is that the former knows how to take a size, while the latter is ignorant of that duty. Sizes when turning are generally taken either with a pair of callipers or a standard gauge. It would naturally be supposed that with the gauge, inaccuracy of measurement would be impossible. It is possible, however, and frequent, because the workman has not sufficient delicacy of touch to use the gauge properly. Callipers are very sensitive and are often used for extra nice work; if, however, the work has to be multiplied many times, then the use of callippers is not economical, and we must substitute some other method; moreover, gauges are costly tools, and but few shops are able to own complete sets; for general work, therefore, we must rely upon the callipers. Blacksmiths have tools which resemble callipers, but they are uncouth and rude. The majority of men of that calling, when using them, set their callipers somewhere near the size they want, and then upon comparing the work with them, *jab* them over the rod or shaft, as if they were going to cut it in two. The consequence is that the size of the work finished depends very greatly upon the resistance which the joint opposes to the blacksmith's strength. It is needless to remind the machinist

CAPTAIN COLES'S PATENT IRON TRIPOD MASTS.



No. 1.—Shield Ship under all plain sail, with Tripod Masts, spreading 32,456 square feet of canvas.
Note.—Main Topmast is here fidded, as may be, if preferred.



No. 2.—Shield, with a broadside of eight 300-pounders, prepared for action, with her yards braced fore and aft.

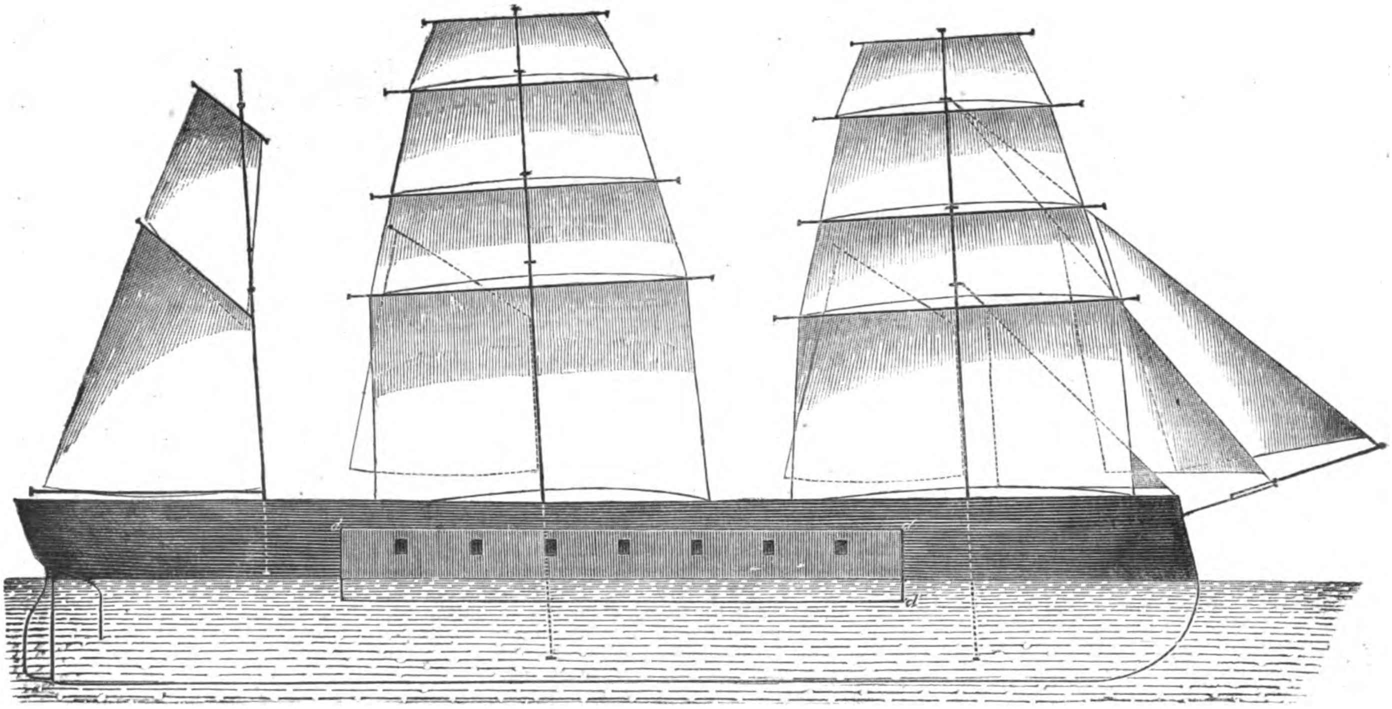
that violence or pressure, applied to tools of this kind, only distorts the measurement and results in "bad jobs." The object with some workmen seems to be to find out how much the callipers will spring in going over a shaft without altering; not to ascertain how much metal must be removed before the requisite dimensions are attained. It is safer to go by the sense of sight than it is by the sense of feeling, in all cases where it is practicable to do so. When we can see that the callipers barely touch the object measured, we know it is of the proper size, but when we only feel of it, accuracy depends almost wholly upon a delicacy of feeling which all persons do not possess. When we say accuracy, we do not mean hap-hazard accuracy, that will admit of being somewhere in the neighbourhood of the right size, but we mean absolute mechanical integrity, such as is obtained in the sewing machine and in the manufacture of our best steam-engines. Many new inventions are rendered useless and thrown aside as impracticable, solely because rudely made; let us then endeavour in the use of all tools, but more especially in the employment of those upon which the proper working of other parts depends upon good fits, to be as faithful as our abilities will allow us to be.—*Scientific American.*

CAPTAIN COLES'S PATENT IRON TRIPOD MASTS.

THE iron tripod masts, lately patented by Capt. Cowper Coles, R.N., and particularly alluded to by Lord Clarence Paget on Monday evening last, consists in constructing masts of a central and two or more side tubes of iron or steel.

The tubes pass through and are keyed to the decks, the central or main tube being carried up to form the topmast—the two side tubes being carried up to the height of the lower yard, thus forming a tripod lower mast, the topmast being secured as a Palacca mast with two very large buckstays, outriggers, and stays. The lower masts

CAPTAIN COLES'S PATENT IRON TRIPOD MASTS.



No. 3.—"Defence" under all plain sail, spreading 22,251 square feet of canvas.
N.B.—The shaded portions, *d*, *d*, *d*, *d*, are covered with armour. Broadside, seven 68-pounders.

become as it were self-supporting, and shrouds and other supporting rigging are dispensed with. If preferred, a topmast may be fidded in the ordinary manner, but the Palacca has many advantages. It has been often erroneously asserted that shield ships could never be turned into efficient sea-going vessels, from the great difficulty which would be found in masting them. Now, so far from this being the case, they can be masted with the greatest ease, and the system which Capt. Coles applies to them, and which can be used in any other description of ships with very great advantage, enables them to spread, when under all plain sail, one half more square feet of canvass in proportion to their tonnage than if rigged according to the method at present adapted for our iron-clads by the Admiralty. It may, therefore, be fairly assumed that they would have under canvas a proportionate advantage in speed. The principle itself may be shortly described as the substitution of rigid iron tubes, for the lower rigging, thus forming with the masts a tripod, but the subject will be best explained by the following diagrams. Diagram No. 1 represents a shield ship of nearly the same tonnage as the "Defence" class, viz., shield ship, 3,700 tons; "Defence," 3,720 tons. A perusal of the following table will give an idea of their general dimensions, armament, and spread of canvas.

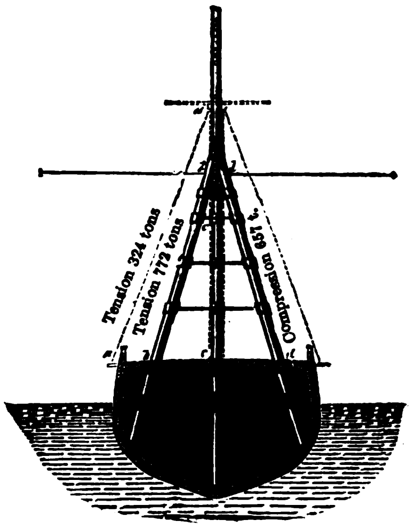
GENERAL DIMENSIONS, &c., OF "DEFENCE" CLASS AND SHIELD SHIP WITH TRIPOD MASTS.

NAME.	If partially or wholly Cased.	Thickness of Armour Plating.	Length.	Beam.	Draught of Water.	Number of Men.	Guns in one Broadside, protected by Armour.	Weight of one Broadside in lbs. thrown by Guns protected by Armour.	Tonnage.	Speed.	Spread of Canvas under all plain sails.	Weight of Masts, Sails, and Rigging.	Nominal H.P.	
								lbs.			Sq. ft.	Tons.		
Defence Class.	Partially.	4½	280	54	25·6	455	5 68ps. 2 110ps.	560	3720	11·3	22,251	163	600	It will be seen that the Tripod Masts spread 10,205 square feet more canvas with the same weight.
Shield Ship, with Tripod Masts.	Wholly.	4½	285	50	23·0	300	8 300ps.	2,400	3700	13·0	32,456	160	800	

Drawing No. 2 represents the ship prepared for action. The topgallant masts and yards having been struck and stowed, either on deck or between decks, nothing being left aloft but the iron tripod lower masts, with their long mastheads on topmasts. The lower and topsail yards are iron, fitted with Cunningham's topsails, which, when the ship is going into action, can be either rolled up or set as illustrated at *a a a a*. In the latter case, with the yards braced fore and aft, the sails would assist in keeping the ship steady, and by so doing add no little to the accuracy of the practice, and to the effect which would be produced upon the enemy, by the eight 300-pounders, with which, as will be seen, the shield ship is armed. The following advantages are contemplated from using iron tripod masts.

1. From there being no lower rigging, the great training powers of the shield are not interfered with; even with ordinary rigging the guns in shields would have greater training than when in broadside port holes.

2. From their being no lower stays, the yards can be braced nearly fore and aft, or in a line with the keel, enabling a ship so rigged to set her square sails, and when under steam steer her course, when, with the present rig, she would be obliged to keep her square sails furled; indeed, square sails fitted on these masts would stand as long, if not longer, than fore and aft sails, with the gaff bagging over to leeward. Naval men all know how much more powerful square sails are than fore and aft sails; and, in conjunction with Mr. Cunningham's self-reefing topsail, this is most important for screw ships. On steaming head to wind, the yards being braced fore and aft, and there being little rigging on top-hamper on the topmast, there would be but a small resistance to the wind.



No. 4.—*a*, *a*, represents the lower rigging by which the main of a ship would be secured by the old plan, viz., nine six-inch wire shrouds of a side, the cohesion or breaking strain of which is equal to (9 × 36) = 324 tons.

b, *b*, represents one tube or support of the tripod masts, the cohesion or breaking strain of which is equal to 772 tons. But the centre tube or mast, *c*, *c*, would also be supported by the opposite tube, *d*, *d*, for when the ship rolled one would be in tension while the other was in compression, making the comparative support of tubes and rigging as (772 + 657) = 1,429 tons to 324 tons.

3. In going into action, the topsails can be set or taken in without exposing any of the men aloft, or even on the deck, the topsail, halyards, and sheets, being led down through the cylindrical masts and worked between decks.

4. When these masts are shot away in action, from there being no lower rigging, they would, being of iron, sink at once, as would the yards from the same cause. This, with the absence of lower rigging would greatly lessen the chance of the screw being fouled, one of the greatest dangers to which our ships are now exposed.

5. The masts will be much stronger and more durable than wooden ones, secured according to the present mode by numerous shrouds. Their relative strength would be as shown in diagram No. 4; and it is supposed they would possess the further advantage of being fireproof. If one of these legs were badly wounded, or shot away, the other two would mutually support each other; but how different with a single mast, which, when badly wounded, or shot away, the rigging, instead of supporting it, tends to pull it down.

6. From their being hollow they would afford additional means of ventilation in all weathers.

7. From their great strength, ships blockading or on other service, in heavy weather, would be better enabled to keep the sea and maintain their stations.

8. They afford great powers of defence against boarders by means of the mast platforms for small arm men, who would be protected by wet hammocks, *b b b b*. With the fire from these and from the turrets, which are not only shields for their guns, but rifle towers, there need be little fear of boarders making any lodgment on the decks for the purpose of attempting the much talked of "wedging the shield."

9. These masts will better withstand the shock received by the ship when giving another the stern, or when striking the shore.

10. They will, as already stated, give a greater spread of canvas with less weight than the ordinary masts with rigging, as will be seen ("Defence") with Admiralty rig, diagram 3, and shield ship with tripod rig, No. 1. Further, all the sails and yards being of the same size, the spare ones will answer for either mast.

11. The sails are so balanced as to enable the ship to stern and work well; the points of difficulty in the present rig, which are frequently the cause of serious complaints.

12. The distance between each mast in the proposed rig being governed by the yards not locking when braced up on different tacks, instead of the mizen and main masts being placed close together, whilst a great distance is left between the main and foremast, as in the "Defence" (see diagram No. 3.) Captain Coles is enabled to place the centre of effort well before the centre of flotation, so that the ship will work well, particularly in wearing, which is very far from being the case with the iron-cased ships, rigged in the usual unhandy manner. The great cause of the defective working powers of these ships is chiefly attributable to their mainmasts being placed too far aft; another is to be found in their not being able to set a sufficient quantity of canvas in proportion to their tonnage. This latter is a very grave defect, for it renders an iron-cased ship incapable, in many cases, of keeping its position in a fleet when under sail, and at a time when it may perhaps be of great importance that as little fuel should be burnt as possible. We have an expensive instance of this defect in the "Defence" during the Baltic cruise. This plan has another advantage; none of the yards are more than 91 ft. long. We lately heard of the "Warrior's" mainyard being carried away. There are a number of gigantic yards in use at the present day—yards some 105 feet long—which are frequently carried away, and that not from any want of skill or seamanship, but simply from the weakness consequent on their great length.

13. The topsail yards can be lowered down on the lower yards in action, and the two lashed together, so that if one is shot away it will be kept aloft by the other.

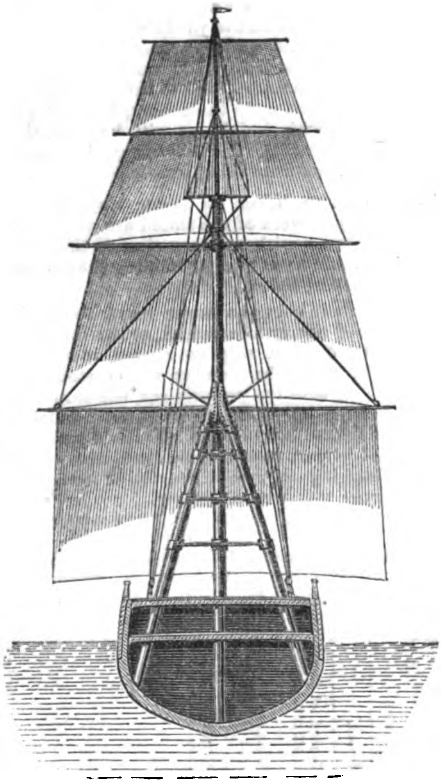
14. The last, though not the least, advantage to be derived from the adoption of these tripod masts would be the great saving which would be effected in the expense annually incurred through the enormous deterioration in the rigging of those men-of-war which it is thought necessary, according to the present system, to keep ready for service in the steam reserve. Ships with the tripod mast would always be comparatively ready for sea, and whilst their perishable sails and running rigging remained stowed away below, nothing would be exposed to the mercy of the elements their iron masts and yards, as shown in diagram No. 2. Important as this tripod rig may appear for men-of-war, we believe it will be found useful for our mercantile marine, when advantages will arise from the saving of wear and tear of rigging and of loss of life and property.

Diagram No. 4 will give its relative strength. The tripod mast is secured as when heaving a ship down, viz., by shears, and seamen well know the enormous strain that a mast so secured will bear. It has to be remembered that with rope shrouds a mast is only sustained on one side, unless the vessel is dead before the wind; but the tripod masts will receive support on all sides; for whilst one portion of the structure is in tension the others would be in compression, so that each portion of the structure would be doing its work towards resisting the strain that may be brought against it, whether from pitching, rolling, or any other cause. From this great strength we conclude it will be impossible for a ship to loose her lower masts from the elements.

It is well known, that being dismasted is one of the most frequent causes of ships being lost or deserted, and that the annual loss of life and property is something fearful to contemplate; and even when a dismasted ship is picked up or saved by another, having been reduced to this helpless condition, her cargo is frequently ruined from the water which has poured into her whilst lying unmanageable in the trough of the sea.

It has also to be considered that our clipper ships, after a run to China, often require a thorough outfit, if not an entire new set of lower rigging.

Change of climate and temperature often endangers the masts of ships, from the effect produced upon the rigging, whilst change of climate would have little or no effect upon these iron tubular tripod masts; and we think we may reasonably expect they would last as long as any first class iron built ship that they may be placed in.



No. 5.—Elevation of Mainmast, taken from astern.

It may be said that it is necessary for a mast to have some play, and these tripod lower masts would be too rigid; that argument might have held good with old wooden masts, but it is well known now that if an iron mast has play the rivets would work loose, and eventually destroy the mast, so that the more rigid an iron mast can be made the more secure and durable it will be.

INSTITUTION OF CIVIL ENGINEERS.

AT the meeting of the Institute of Civil Engineers, on February 24, John Hawkshaw, Esq., president, in the chair, the first paper read was on "American Timber Bridges," by Mr. J. R. Mosse, M. Inst. C.E.

It was stated that the early common road bridges, for spans of 100 ft. and upwards, were generally built on the lattice plan. The sides, and the top and bottom chords, were formed of planks, usually 12 in. wide by 3 in. thick, fastened together by oak trenails, 2 in. in diameter. For road traffic, with moderate spans, this kind of bridge answered tolerably well; and several of the early railway bridges were constructed in a similar way. But this structure, having been found insufficient for heavy trains, had, long since, been abandoned; though it was sometimes, but erroneously, thought in England to be the general style of American bridges.

The next design noticed was the Howe bridge, a detailed description being given of one on this principle on the Danville Railway, over the James River, at Richmond, Virginia. This bridge consisted of 11 openings, each [illegible] ft. span, the total length being about [illegible] ft., with a width of 18 ft. For each span there were two trusses, the greatest depth of which was [illegible] ft. Each truss was divided into several panels, 11 ft. wide, and the bottom chords were so arranged, that there should be only one joint in the chord pieces in each panel. The sectional area of the upper chords was [illegible] square inches, and of the bottom chords 528 square inches; the greater area of the latter being on account of the numerous joints. There were four main braces at the ends of each truss, and by means of three vertical iron tie-rods in each panel, any required camber could be easily given. Counter-braces were also introduced, by which, when keyed up, the bridge could be so stiffened, that a passing load was said to produce no additional strain. These bridges were always built of the best white pine; and the ordinary price for a single line, including erection, was from £4 to £5 per lineal foot. The usual quantity of timber employed was about 30 cubic feet per lineal foot, and the weight, including iron work, a little more than half a ton per lineal foot. Assuming a load of 3,000 lbs., including its own weight, to be uniformly distributed over the bridge alluded to, the strains would be, by the ordinary calculation,—

	Per sq. in.
On the upper chords, compression,	729 lbs.
,, bottom chords, tension,	547 ,,
,, end braces, compression,	735 ,,
,, end tie-rods, tension,	15,125 ,,

The ordinary dimensions of a bridge on this principle having a span of 150 ft., as built on the Portland Railway, were then given; from which it appeared that, the lower chord pieces of the two trusses had together a sectional area of 676 square in., and of the upper chord pieces of 520 square in. Assuming the same weight of 3,000 lbs. per lineal foot, to be equally distributed over this structure, the strains would be:—

	Per sq. in.
On the upper chords, compression,	901 lbs.
,, bottom chords, tension,	694 ,,
,, end main braces, compression	750 ,,
,, end tie-rods, tension,	18,750 ,,

These strains were greater than in the first example, and the compression of 901 lbs. per square inch on the upper chords was the limit of safety; but it was not probable that the bridge would ever be loaded to the amount assumed.

Owing to the increased weight of the trains, and the greater span of railway bridges, it was afterwards found necessary to strengthen this form of bridge, by the addition of arches on the sides of the trusses. This "Improved Howe Truss," as it was usually called, came into general use. A bridge on this plan was described, which was built for a double line on the Philadelphia and Reading Railway, where it was subject to to the heaviest traffic in America, the coal conveyed over it alone exceeding 5,000 tons daily, besides the ordinary passenger and goods trains. This bridge had a clear span of 160 ft. There were three trusses, each 23 ft. deep, and six arches. The sectional area of the three upper chords was 1,215 square inches, of the bottom chords 1,620 square inches, and of the six arches 1,530 square inches. The arches were formed of the best pine, in pieces about 24 ft. long by 4¼ in. wide and 15 in. deep. Timber arches had not unfrequently been built of pieces 6 in. square; but very rarely of laminated plank, in the manner formerly practised in England. Supposing a load of three tons per lineal foot, including the weight of the structure itself, to be equally distributed over this bridge, and to be borne both by the upper chords and the arches, then the compressive strain per square inch would be 292 lbs. on the former, and 287 lbs. on the latter; while if sustained by the arches alone, the pressure would only amount to 368 lbs. per square inch. As American engineers usually considered 900 lbs. per square inch as the safe limit of compression on timber framing, the strength of this bridge appeared, by calculation, to be greatly in excess of what might be deemed necessary.

The approximate quantities of materials in this bridge, exclusive of the roof, were per lineal foot, 58 cubic feet of timber, 270 lbs. of wrought iron, and 76 lbs. of cast iron; and the cost of the superstructure amounted to £10 3s. per lineal foot.

These bridges were usually built with a camber of about 1 foot; but owing to decay at the joints, and the unseasoned state of the timber when framed, they soon deflected, and did not last in good condition longer than from twelve to fifteen years. When, however, they were roofed in and boarded at the sides, and were properly cared for, their duration might be taken at twenty-five years.

Some American engineers did not approve of the arch in combination with the truss, believing that a structure composed of two systems, neither of which was strong enough by itself, was wrong in principle, and that it was almost impossible so to proportion the strains as to make each system bear its due share. These engineers thought it better, either to add to the truss the material used in the arch, and to have a light truss merely to stiffen the roadway.

Timber-bridge building had become a special branch of engineering in America, and one firm alone—that of Mr. D. C. McCallum—had constructed 15 miles on length of bridges upon different railways, in spans varying from 30 ft. to 260 ft. These bridges were built on what was termed the "Inflexible Arched Truss" principle; and a description was given of a bridge, for a single line of railway, 200 ft. span, of which several had been erected in the States of New York, Ohio, and Mississippi. The principal dimensions were—total length, 210 ft.; span, 200 ft.; depth of truss in the centre, 26 ft., and at the ends, 21 ft. The arched tops of the two trusses had together a sectional area of 814 square inches, and the two bottom chords of 468 square inches. There were four main braces, which projected 32 ft. from the piers, having a sectional area of 704 square inches on each side. The posts, of which there was a double row, inserted between the chords, varied from 9 in. by 13 in. at the abutments to 9 in. by 6 in. at the centre; the counter-braces being 9 in. by 6 in. throughout. Special attention was directed to the manner in which the bottom chords were scarfed, by long splicing pieces and combination keys, so as to prevent them, as much as possible, from stretching. The spur arch braces also transferred the load directly unto the abutments, by which the span was directly reduced to 136 ft., so far as the strain on the truss was concerned. This bridge contained 7,360 cubic feet of timber, 6,958 lbs. of wrought iron, and 5,997 lbs. of cast iron. Its total cost was £5 4s. per lineal foot; the rough timber being delivered on the site of the works at one shilling per cubic foot. The total weight, including the permanent way, was 109 tons, and with an additional load of 205 tons, equally distributed, the pressure on the arched top would be 862 lbs., and the tension on the bottom chords would be 1,500 lbs. per square inch. With an actual load of nearly one ton per lineal foot, this bridge deflected nearly three-quarters of an inch, previous to the adjustment of the counter braces; these were then screwed up, and the load was removed, when the permanent deflection was found to be nearly five-eighths of an inch.

Several railway swing bridges, of 120 ft. span, had been constructed of timber by Mr McCallum, and the principal dimensions, as well as detailed drawings, of one on a similar plan, proposed to be erected over the Mississippi river, at Clinton, Ohio, were given. A McCallum common road bridge, of 150 ft. span, was then described; and it was stated that the quantity of timber in such a bridge, 20 ft. in width, did not exceed 23 cubic ft. per lineal foot, its entire cost amounting only to £3 2s. 6d. per lineal foot, the rough timber delivered on the ground being estimated at 9d. per cubic foot.

As an illustration of the adaptation of the Howe Truss for large roofs, a description was given of that erected at the Dunkirk station of the New York and Erie Railway, the span of which was 80 ft. This roof was chiefly remarkable for the lightness of the scantlings, only two pieces of timber being as large as 6 in. by 7 in., and most of them were about 5 in. by 7 in. A principal of this roof contained 280 cubic ft., and would cost, at the ordinary price for timber framing, including erection, about £36.

In conclusion, the author expressed the hope that these specimens of timber work, the result of many years' experience, and the adaptation of the only available resources of a new and comparatively poor country, would be found interesting; as, whatever their merits or faults, the bridges had undoubtedly produced good practical results, and would bear investigation.

The second paper read was "On the Reconstruction of the Dinting and the Mottram Viaducts," by Mr. W. Fairbairn, F.R.S., M. Inst. C.E.

After alluding to the many advantages resulting from the application of a tenacious but flexible material, like wrought-iron, either in the tubular girder, or other forms in which it was now employed, as being probably the most suitable for bridges and viaducts of great width and span, where strength and durability were required, the author remarked, that at the present time there did not appear to exist any inducement on the score of economy, for the introduction of a perishable material, such as timber, into structures intended to be of a permanent character. He then briefly described the original condition of the Dinting and Mottram Viaducts, on the Sheffield and Manchester Railway, which were erected in the year 1843-44, under the direction of the late Mr. Joseph Locke The former consisted of five arches of 125 ft. span, the latter of one arch of 150ft., and of two of 125ft. span, constructed of timber ribs on the laminated principle. As was generally the case with similar structures, within ten or twelve years after their erection, the timber was so much decayed as to endanger their security, and to render considerable repairs indispensable. It was then contemplated to substitute iron work, but this step was not finally determined upon until the year 1858, when the viaducts were again in such a state as to alarm the passengers. It was stated that the restored portions for each viaduct consisted of two longitudinal and continuous tubular iron girders, fixed to the middle piers, and free to expand and contract in the direction of the abutments. To the top of these girders iron cross beams were rivetted, on which were laid the longitudinal sleepers for supporting the rails. There was nothing new in the construction of the girders. They were one-thirteenth of the span in depth, and the areas of the top and bottom flanges were in the proportion of 7 to 6, the breaking weight, equally distributed, amounting to 12·58 tons per lineal foot. The chief novelty was in the mode of erection, and in the method of substituting iron for wood; the directors of the railway company having insisted on the condition that the traffic should not be interrupted during the progress of the works. Several plans were proposed, but that which was ultimately adopted was to construct the girders on the old existing platforms, to cut down the piers and the abutments, and then, by a simple mechanical apparatus, first to suspend and afterwards to lower the girders into their places. A strong wooden frame, about 16 ft. high, was erected on the pier at each end of the girder, and on the top of this was inserted a cast-iron plate, with a hole in the centre, through which a square-threaded screw, 4½ in. in diameter, was passed. Centred on this screw, and resting on the cast-iron plate, was a bevel wheel, which received motion from a pinion, in connection with spur gearing, worked by crank handles in the ordinary manner. On the lower end of the large screw was forged an eye, to receive a cross-bar, having links at each extremity, which hooked under the angle irons at the sides of the girder. With six men at the handles, each girder was raised and lowered into its place in one hour. When one line of girders was thus completed—the whole of the traffic having in the meanwhile been carried by a single road—a temporary way was laid upon this line of girders, and the traffic was transferred to it. The girders on the other side of the viaduct were next constructed, and when they were finished, the iron cross-beams were rivetted to these girders, and the permanent way for this line was made good. The trains were again passed on to this road, the permanent way on the other side was laid, the timber arches and the framing were removed, and the viaduct was complete.

In consequence of the marriage of his Royal Highness the Prince of Wales having been fixed for Tuesday, the 10th of March, it was resolved that there should not be any meeting of the institution on the evening of that day.

Meetings for the Week.

Mon.—*Royal Inst.*, General Monthly Meeting, at 2 p.m.
Soc. of Engineers, "On the Relation between the Safe Load and the ultimate Strength of Iron," by Mr. Zerah Colburn, at 7 p.m.
Tues.—*Inst. Civil Engineers*, "The Perennial and Flood Waters of the Upper Thames," by Rev. J. C. Clutterbuck, M.A., at 8 p.m.
Royal Inst., "On Animal Mechanics," by Professor Marshall, at 3 p.m.
Wed.—*London Inst.*, "On the Zoology of Warm-Blooded Vertebrata," by C. C. Blake, Esq., at 7 p.m.
Soc. of Arts, "On the Construction of Twin Screw Steam Ships," by Capt. T. E. Symonds, R.N., at 8 p.m.
Geological Soc., 1, "On the Permian Rocks of the North-Eastern parts of Bohemia," by Sir R. I. Murchison, K.C.B., &c. 2, "On the Correlation of the several divisions of the Inferior Oolite in the Middle and South of England, by H. B. Hall, Esq., at 8 p.m.
Thur.—*Antiquaries*, at 8.30 p.m.
Royal Inst., "On Chemical Affinity," by Dr. E. Frankland, F.R.S., at 3 p.m.
Chemical, at 8 p.m.
Royal Soc., at 8.30 p.m.
Linnean, at 8 p.m.
Fri. — *Royal Inst.*, "On Recent Spectrum Discoveries," by Dr. A. W. Miller, at 8 p.m.
London Inst., "On Economic Botany,"' by R. Bentley, Esq., at 7 p.m.
Architectural Assoc., "The Architecture of Napoleon III.," by R. Phenè Spiers, A.I.B.A.
Sat. — *Royal Inst*, "On the Science of Language," by Prof. Max Müller, at 3 p.m.

TO CORRESPONDENTS.

Received. – Madle. T, W. H. P., J. C., G. A. W., Capt. C. P. C., G. H. B., A. and P., T. R. K., W. H. C., W. H. P.

J. C.—Want of space compels us to omit your communication till our next.

G. P. (Manchester.)—No.

Iron.—In a work entitled "A Course of Instruction in Guns and Artillery," by Capt. J. G. Benton, New York, 1862, you will find what you require. You can get it through most "foreign" booksellers. There is a copy in the Patent Office Library, Southampton-buildings The price is about ten shillings.

Ruhmkorff.—You will probably find what you want in De la Rive's "Treatise on Electricity."

I.—We cannot at present definitely answer the first of your questions. As regards the second, we believe that the Iron Plate Committee is still extant. Ships without a wooden backing are now being built, but no ship of this description has yet been fully tried.

John W. (Gosport).—The *gross* amount of income is taken into account, not the *nett* sum. We therefore fear that you must pay the text.

Agricola.—The principal merit of introducing the steam-plough undoubtedly belongs to Mr. John Fowler, of Leeds. We wish him *every* success. Without a patent law, he would stand no chance in getting back the immense sums he has lavished on experiments.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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THE CHIEF CONSTRUCTOR OF THE NAVY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In your impression of last week you denounce the Armstrong job, and lay bare the manœuvres and motives of its authors in terms which every honest man must approve. The manner in which you have for a long time, single handed, and always consistently, for more than three years, exposed and attacked the gross misrepresentations and partial influences of the leading journal and the Government officials in support of the monster monopoly, does honour to the MECHANICS' MAGAZINE.

All your exertions, however public spirited and high-minded as they doubtless were, have been of no avail to save the country from the expenditure of more than £4,000,000, which have been as much thrown away, at the cost of the oppressed tax-payers, as if the money had been cast into the sea. In spite of your vigilance, the horse was stolen before the stable door was shut. The conspirators planted, and reaped, and gathered the golden harvest at the public expense, with the public eye upon them, and in defiance of public censure. The "Auri sacra fames" was more powerful in high places than patriotism or political honour.

As a measure of public utility the Armstrong scheme has miserably collapsed; as a commercial speculation, which was the sole object of its authors, it is a magnificent success. The partners in the undertaking are enormously enriched. The nation finds itself in the condition of a country which has been overrun and sacked by an invading host, and allowed the enemy to retire unmolested with the spoils of a successful invasion. That catastrophe you would, I am sure, have prevented had it been in your power; and if your attention is awakened to the possible perpetration of another official job, which in its magnitude and disastrous results to the national exchequer and the national defence, if not nipped in the bud, may surpass the "Armstrong iniquity." I make no doubt the MECHANICS' MAGAZINE will signalise itself as much in the new field as it has already done on the great gun question.

The possession of the best ordnance for the land or sea service is an important object, but the possession of the best military navy is one of vastly greater proportions. The gun is a vital part of a man-of-war, but the ship itself, in the aggregate of its construction — its sea-going properties, its strength as a ship, its speed, and, above all, its force of resistance to artillery, is an object involving scientific, mechanical, and structural considerations of the highest order. All the knowledge, all the ability founded on theory and practice, requisite to grapple with these difficult questions, are under the organization of the constructive department required to be concentrated in one man, and that man is the Chief Constructor of the Royal Navy. A late trial, "Clare *versus* the Admiralty," disclosed the fact that the Controller, so far as construction is concerned, is an instrument in the hands of the Chief Constructor. The evidence in that case proved that Sir Baldwin Walker was represented to be the designer of the "Warrior;" but that in fact it is to Mr. Isaac Watts, the Chief Constructor, that the honour of that distinction, whatever it may be worth, is due. How, indeed, is it possible that a naval officer, whose life has been spent in mastering the theory and practice of his own arduous profession, and in attaining its superior grades by slow degrees, should be a naval architect? But the public, uninitiated in such matters, should be undeceived. Things should be called by their right names, and men should be put in their right places. It is no discredit to Admiral Robinson, any more than it was to Sir B. Walker, that he should not be equal to the task of naval construction, or that he should find the chief officer under his *control controls* him. Nor is it to be wondered at that when he conceives he has made the discovery that the officer in whom he has to rely is incapable of exercising a proper control over him, he should seek to place himself under the guidance of a more efficient and a safer adviser. On this principle the recent change at the Admiralty, the retirement of Mr. Watts, and the appointment of Mr. Reed, may be reasonably accounted for. The Controller, we must conclude, has discovered that the former is not up to his work, and we are led by Lord Clarence Paget to infer that he is wanting in the requisite activity. But have the powers of Mr. Watts suddenly failed? Is he not the designer of the "Warrior"—that model frigate, which is held up as the type of iron-clads? I submit these reflections to consideration. They raise the thought that more is meant than meets the eye in this off-hand change in the *personnel* of the constructive department, which, if we may credit a foreshadowing in the *Times*, apparently confirmed by the Secretary of the Admiralty, will be followed up by the removal of other "gentlemen who, although very eminent, are rather old."

But, admitting the soundness of these conclusions two important questions present themselves:—Have we, in the new appointment, got the right man in the right place, or is he an instrument to carry out some cherished plan of the Admiralty, and aid in organizing a gigantic scheme of reconstruction, in which the national wealth and the national interest may be more wasted and compromised than they have been by the Armstrong combination? I confess to grave doubts of that nature, and I will give the reasons why.

Mr. E. J. Reed, whatever may be said of his merits (the *Times* and other papers, including the MECHANICS' MAGAZINE, have not been sparing in their praises of his talents), is an untried man—untried with the exception of the "construction of *one vessel according to his own invention*;" and Lord Clarence Paget informs us "he has done his work extremely well." I pause here to remark that the construction of that *one vessel*, like any other vessel built in the royal dockyards, is the work of the highly trained and thoroughly practical body of shipwrights, masters, and men, who execute the work of any design placed in their hands, in the highest degree of perfection. The credit, then, due to Mr. Reed is simply the design of this vessel of his own invention. That is his title to public confidence. "By his works shall he be judged;" never was an axiom more true than this, as a physical and mental as well as moral test.

With the one exception above mentioned, Mr. Reed's practical experience is a blank. In early youth he studied the theory of naval architecture, and served his time as a draughtsman in the School of Naval Construction. Doubtless, he became a proficient in drawing plans of ships, but there is nothing to show he acquired peculiar eminence, or surpassed his contemporaries in that academy. Whether it was from unwillingness to handle the maul and the adze, or a want of perseverance to pass through the drudgery which is the road to preferment in the public service, he relinquished the opportunity then open to him as a naval constructor, and never has acquired that practical experience which has given to the country a Watts, a Lang, a Turner, a Moody, and other highly trained and talented master shipwrights, who form the real strength of the department of naval construction. In this practical training the new chief constructor is totally deficient. For many years he devoted himself to literary and scientific pursuits, and was only lately brought into notice as the secretary to the Institute of Naval Architects—a situation for which his theoretical knowledge, his natural abilities, urbanity of manner, and high character, well qualified him. The position in which he was then placed brought him into contact with naval men of both parties. By defending the design of the "Warrior" with much success, against its assailants, he ingratiated himself, not only with the Admiralty, but with Sir John Pakington, the president of the institute, who has a parental affection for the magnificent vessel, which was brought into the world when he was First Lord. These circumstances enabled Mr. Reed to bring the design of the vessel of his invention under the notice of the Controller, and led to arrangements which have terminated in his appointment to the important office he holds.

Many months ago, long before Mr. Reed's elevation to the post of Chief Constructor could be thought possible, I pointed out the nature of the system of naval construction, which recommended him to the favour of the Admiralty. That system is known under the designation of "wooden bottoms with iron top sides;" and I stated my belief that in that disguise it was nothing more than a covert plan for resuming the construction of "wooden ships," which, although armour plated, will still be "wooden ships," and nothing else.

I do not propose to offer any remarks on the design, the speed, or sea-going properties of the "Enterprize" or "Favourite." As models of naval architecture and fast cruizers they may be perfection. I have to regard them only as iron-clads. The question lies in a nut-shell. We must have fast corvettes and sloops. Everyone who understands the subject is at one with Mr. Reed on that point. It is no discovery of his. But are these swift cruizers to be built of wood or of iron? Falling into the views of the Admiralty, Mr. Reed would have us believe they must of necessity, at least, for the present, be of wood. For, coming to this conclusion, he assigns two principal reasons:—1, The bottoms of iron ships are liable to foul. 2, The bottoms of wooden ships are stronger and less liable to damage in the shallow waters, where cruizers of light draught are the most serviceable. These two reasons are the sum and substance of the arguments in support of wooden bottoms. Two other reasons adduced are, employment to a large body of shipwrights thrown out of work by iron shipbuilding, and using up the large stock of timber in the dockyards. But this is begging the question. The efficiency of the navy is not to be put in peril on humanitarian grounds, or to relieve the Admiralty of an imprudent investment. If we are to believe half what has been said about the ready conversion of shipwrights into workers in iron, national humanity and national interest may be allied in the construction of an iron fleet; and, instead of wasting the large stock of timber in store by converting it into vessels, which, in a few years, will be obsolete, and laid up to rot in ordinary, it would be far wiser and more economical to sell off this useless—if useless—stock of timber, and apply the large sum it would produce to build iron sloops and corvettes, which will be serviceable for half a century. Such a course would be true economy, and, at this moment, would not only be a great help to the Exchequer, but a national benefit, by adding to the navy a useful class of iron ships without an increase in the budget. This suggestion may be worth consideration, and I trust some independent member will ask for a return of the nature and value of the stock of timber in the Government dockyards.

The real character of the "Enterprize" and "Favourite" may be briefly described. They are literally wooden vessels partially protected with iron armour. To call them anything else is a misnomer, to conceal the truth. From the keel to the gunwale they are of wood. They are built with wooden timbers and wooden planks, and, to form a backing to the armour, the spaces are filled in with wood. The structure is strengthened with iron knees and iron stringers, and great solidity is given to the sides, which are stated to be 18 in. thick, but still they are unequivocally wooden vessels. The iron top sides are independent of the hull, so far as displacement and sea-going strength are concerned. These upper works are rather a source of weakness than of strength, inasmuch that if they were of wood, and were formed to be supported by continuations of the timbers which form the hull, the vessel would be more sea-worthy. These remarks apply only to the ship as a ship, without reference to her qualities as an iron-clad.

The armour plating is divided into, and applied to, two parts. One is termed by the inventor of the system the "belt" armour; the other the "backing" armour. The former commences below the water-line, and continues to the gunwale. The latter protects the battery, which is a square fighting box, similar to that of the "Warrior," occupying the centre of the main deck, armour-plated on each broadside and at the ends athwartship, the width of the deck. There is no invention in this arrangement; it is copied from the "Warrior." As to the arrangement for fighting four guns, either at the broadside or fore and aft ports, I have nothing to say at present, except that four guns cannot be fired from eight ports simultaneously; and the novel expedient of shifting guns from one port to another, in the heat of action, has yet to be tried before its advantage can be determined.

The main consideration is the efficiency of the protective armour. It consists of 4½ in. plates diminishing to 3 in. on a wood backing of 18 in., which, in the case of the belt, is the hull of the ship itself. It has been asserted, that with this system of armour, the vessel is as completely protected as the "Warrior;" but that is a misrepresentation, because in addition to 18 in. of teak backing, the "Warrior" is protected by her iron skin and framing, which, together, offer greater resistance to projectiles than the 18 in. of wood. The iron-cased belt of the "Enterprise" is of the same strength only as the armour plates and teak backing of the "Warrior," and is, therefore, far from being as completely protected. Wanting the support of an iron hull at the back of the 18 in. of wood, the planks and timbers of the "Enterprise" will be crushed in or splintered by the impact of 7 and 8 in. solid shot, even though the plates should not be perforated. The certainty of that result is demonstrated by the effect produced on the planks and timbers of wooden ships in testing armour plates at Portsmouth. As to shell, the late trials at Shoeburyness leave no doubt that explosive projectiles will pierce through the 4½-inch armour, and set a wooden ship in flames. In an engagement with a completely protected and heavily-armed *iron* iron-cased ship, the "Enterprise" would, at close quarters, be destroyed, or strike her colours in a few minutes.

Such is the class of ships, which it appears to be the special mission of the new Chief Constructor to aid the Controller to introduce into the navy. It is, under the circumstances described, impossible to disconnect the scheme and its author, whose sudden promotion over the heads of his more experienced and practical seniors, interpreted as it is by the articles in the *Times*, strongly eulogistic of the coming man and his system of wooden iron-clads, leave little doubt, in my mind, of the intention of the Admiralty. There will be, we are led to expect, sweeping reforms in the department of naval design and construction. The new-born Chief, we are assured, combines in his person "special qualifications for his post, resulting from the highest training in the theory and *practice* of ship building;" and the first duty imposed upon him is to remove from office his present subordinates, who, it is insinuated, are "effete nullities," and ought to be replaced by "more highly-educated assistants taken from the training school of mathematics and naval construction."

These reflections on the *personnel* of the Controller's Department are anything but complimentary to the persons of whom it is composed. Similar opinions have been before expressed; but it is by no means certain that any change of persons, under the present "system," will bring about that reform in Whitehall which is so urgently required. If the occupants of office are *effete*, it is because the system itself is essentially so, and it would be as rational to attempt to restore old age to youth by transfusion, as to change the character of Admiralty administration by substitution of persons, who, whatever may be their ability, can only be instruments of a corrupt, a torpid, and a cumbrous department. If the panegyrics on the new "Chief Constructor," are well bestowed, Mr. Reed might be hailed as the "Young Napoleon" of the Admiralty. Time will show whether it is possible for genius to surmount the dead weight of a vicious administration, any more in Whitehall than in Washington.

Under a constitutional *regime* we must not rely upon mere personal talent or influences. The most scrupulous conservative may prefer a change of "system," and rally to the cry of "measures not men," because good measures must be founded on a good system, which will put the right men in the right places.

The development of the Reed scheme should be closely watched. It cannot be allowed that the Chief Constructor, as it has been asserted, comes into place free from "bias" in favour of wood or iron, as the material for naval construction. Much less can it be said that he is not an inventor. Is it not notorious, and is it not announced by the Secretary to the Admiralty, that he is the inventor of "wooden bottoms with iron top sides," of which he claims to be the original designer? His alleged "immunity from bias" may be likened to that of the patient animal between two bundles of hay, or to the Macheath sentiment, "How happy could I be with either," for Mr. Reed by turns has been the staunch advocate of iron ships, and the derider of the "men of iron at any price." He has staked his reputation on the hermaphrodite class of cruisers, which are neither wood nor iron, but a mysterious combination of both. As to his practical knowledge, it has been shown what it is.

The origin and progress of the relations between Mr. Reed and the Controller's Department, strengthen the impression that the composite ship may be a contrivance to enable the Admiralty to resume the construction of a wooden navy. The prominence suddenly given to the author of the plan, and the exalted patronage bestowed upon him, favour the suggestion that such a design is intended to be carried out in opposition to the recorded will of the House of Commons, that no more wooden ships shall be built.

The contest between wood and iron is culminating. My predilections are decidedly in favour of iron. I may be accused of having a "bias," but the occasion of arriving at a right conclusion is at hand. The navy estimates are brought forward. Should a vote be proposed for the construction of a fleet of "wooden bottoms," it may be concluded that Mr. Reed's mission is to uphold wood against iron. In that event, I trust you, Sir, will cordially give your support to a proposal that Government shall be required to make a trial of a wooden iron-clad target constructed on the Reed plan, before the construction of another "Enterprise" or "Favourite" be commenced.

The House of Commons, if it does its duty, must interpose and prevent a repetition of the monstrous folly of building a fleet of iron-clads on a plan not previously tested. The trial of the "Warrior" system of armour-plating was not made at Shoeburyness until after that vessel was built and ready for sea, and eight or ten other ships, to be protected in the same way, were under construction. Whatever may be the merits of the "Warrior" plan, a better one is allowed to be a desideratum. The Reed plan will unquestionably be vastly inferior in efficiency. A target trial will settle the point, and may prove it to be worthless. This trial ought to be made! The country is to be relieved from the incubus of the Elswick Ordnance Company; at an enormous sacrifice, it is true, but this sacrifice may have its utility. It may rouse the Legislature to step in at the opportune moment, and, by insisting upon a trial of the Reed system, it may avert the possible danger of a waste of the public money on a scale more prodigal than that resulting from "Armstrong diplomacy."

I am, &c.,

CIVILIAN.

CUPOLA SHIPS.

SIR,—In the discussion last night on the naval estimates, Lord Clarence Paget, having stated that cupola ships would be under a disadvantage when fighting both sides, will you kindly allow me space for the following facts, viz.:—

"Defence" throws a broadside of 560 pounds, and is 3,720 tons. The "Prince Albert" shield ship throws a broadside of 1,120 pounds, and is 2,529 tons, and has the power of fighting half her guns on either sides, giving her then a broadside of 560 pounds, or equal to the "Defence," although the "Prince Albert" is 1,600 tons smaller.

I am, &c.,

COWPER P. COLES.

London, Feb. 24.

SUBMARINE TELEGRAPHY.

SIR,—Judging from the harmless nature of the fire returned by "An Old Sailor" in your last issue, I am sadly afraid I hit him harder than I intended—in short, that my shot struck him below the water-line and crippled him outright. He throws out a hint, however, of which I avail myself, by closing my correspondence with him at this point.

"An Old Sailor" says:—"If Dr. Wallich considered my observations worth answering at all he should have replied with temper." Why, the fact is, my missiles were too well tempered—they were steel-headed, otherwise it is difficult to conceive how "An Old Sailor" could have penned such a chaotic sentence as the following:—"Whether a writer in your paper announces his name or writes anonymously, I apprehend that so long as he writes common sense, and his arguments on the subject are sound, it matters little to your readers."

Having failed to detect the "common sense," or "sound argument," which "An Old Sailor" declares he has "written," I beg leave to assure him I shall neither trespass on your space nor your readers' good nature, by attempting to refute assertions which, I repeat, are unsupported and irresponsibly made.

When "An Old Sailor" shall have perfected his scheme of "a voyage to the moon," which he tells us he "may propose," perhaps he and the public may unanimously agree in its being a fitting opportunity to break his *incognito*.

I am, &c.

G. C. WALLICH.

Kensington, Feb. 23, 1863.

[We do not see the necessity of sneering at an "An Old Sailor," because he does not reveal his name. Almost all journalism in this country is anonymous. It may not be always convenient or politic for a writer to sign his name; and we beg to inform Dr. Wallich that "An Old Sailor" is quite competent both from experience and position to write on this subject.—ED. *M. M.*]

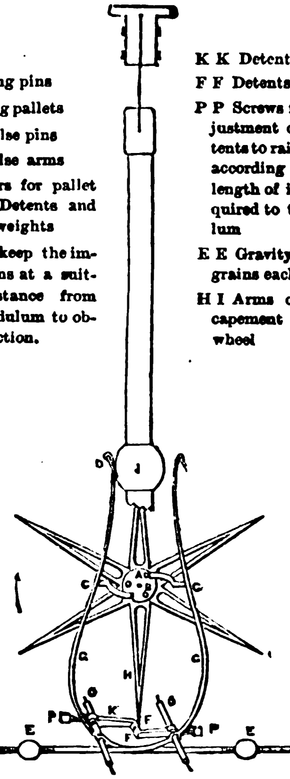
ON GRAVITY ESCAPEMENTS FOR CLOCKS.

SIR,—The interest I have for many years taken in the progress of horological science, and in carrying into practical effect various designs with the view of improving and simplifing the principles of time-keepers, induces my offering for publication in your valuable journal the following observations as the result of my own experience in reference to gravity escapements for astronomical clocks and turret clocks of large dimensions. I might not have troubled you, at the present moment, had not an article on the subject of gravity escapements, by Mr. E. B. Denison, appeared in the MECHANICS' MAGAZINE for February 13th, 1863, justifying a few observations on my part, in which, for the purpose of distinction, I may mention names as referring to inventions only, but without any controversial intent or bias on either hand.

In my remarks here it will be not necessary to say anything on the general construction or purpose of gravity escapements, after the description given by Mr. Denison, illustrated by five diagrams in the above mentioned paper, and in his rudimental treatise on clocks, both which may be referred to; he, however, after describing clocks of his own construction, speaks of other clocks in the International Exhibition somewhat disparagingly, without having, as it appears to me, sufficiently investigated some points of real importance distinguishing one particular clock, to enable him to report fairly on its merits, as evidenced by statements in his paper diametrically opposed to the manifest properties of the clock so criticised; and in every instance without mentioning the names of the respective exhibitors of other clocks as a guide to the reader.

To observers familiar with the various specimens, the intention of Mr. Denison, in the several comments, will be sufficiently obvious.

As touching the priority of invention relating to gravity escapements having a scape wheel with a few long teeth for locking, and a few very short ones or pins near the centre for lifting the pallet (and to which in an early model of my own construction I had employed a fly, carried by an extra pinion), but did not apply one to the clock I am about to describe, as it performed well in its simple condition, and would only *trip* when an *excess* of force was applied to the strain.



A B Lifting pins

C C Lifting pallets

D D Impulse pins

G G Impulse arms

O O Arbors for pallet arms. Detents and gravity weights

J Boss to keep the impulse pins at a suitable distance from the pendulum to obviate friction.

K K Detent arms

F F Detents or stops

P P Screws for the adjustment of the Detents to raise or lower according to the length of impulse required to the pendulum

E E Gravity weights 5 grains each

H I Arms of the escapement or star-wheel

Mr. Denison says, "Of the classes of escapements or clocks, with and without the fly, the latter class is represented by Mr. Bloxam's, and the former, I believe it has never been denied, are mine." To this remark I am justified in replying, that a clock in action, having a gravity escapement originally constructed by me of a corresponding principle with that of Mr. Denison, but without a fly, was, for some months, publicly exhibited, A.D. 1843, in the open window of a shop occupied as my place of business, in Piccadilly, just 20 years ago, the other clock being made about three years earlier. In evidence of this, I have the testimony of competent judges, who at the time fully understood the construction and properties of both clocks. I had never, myself, heard of Mr. Denison's escapement until several years later.

Under those circumstances, I think I may fairly claim the originality of this invention, priority on my part being dependent on the later exposition or publication of Mr. Denison's escapement for the Westminster great clock, as appears by the date 1852, given for the first application of a fly to his three-legged gravity escapement.

The above conclusion is drawn from a recent inspection of the great clock in the tower, where I had full opportunity of comparing Mr. Denison's gravity principle with my own.

The particular clock unfavourably commented on, cannot, from the points of principle objected to, be mistaken as to the gravity escapement invented by Dr. Clark. One important property of his principle is its unlocking by the descent of each gravity impulse, weight, and pallet, the invented impulse arm of which acts continuously on the pendulum, until the unlocking of the star wheel is effected. Upon this reversed mode of unlocking by the falling pallet, Mr. Denison says you will have the friction on the stops acting, not merely through a very short arc, and in one direction only, "but first forwards and then backwards through the whole swing of the pendulum, both up and down; in fact, exactly corresponding to the dead friction in a dead escapement."

Both points in the latter portion of the above statement, I find, by an acting model in my own possession, to be entirely a mistake, as in the upward motion of the locking pallet by action of the lifting pins; there is no contact either with the pendulum or with the tooth of repose, which passing gradually away from one pallet until the next tooth is arrested by the other pallet, sufficiently explains the correctness of Dr. Clark's mode of infallible locking, which allows any increase of motive power, without the possibility of tripping, and under a proper direction of the locking planes the arc of vibration will be constant, the quantity and intensity of friction being about 100 times less than in a dead escapement. No oil is required except at the detent pivots, as guarding against rust; this and other advantages stand favourably for the permanent well-going of a clock with this gravity escapement, which, if properly made, would, I believe, be found satisfactory.

I may here express an opinion that, giving impulse on the pendulum rod by inverted impulse arms, induces too small an amount of friction to admit of valid objection, the intersection of the curves at the line of centres for so small an arc of motion being barely appreciable. It is so much less than the detent pivot friction produced by the weight of parts, as to be too fractional for consideration.

The lettered engraving fully illustrates Dr. Clark's arrangement, both lockings being in the vertical line of the pendulum rod; the momentum of the star wheel allows a little re-action of the second hand, but this is completely remedied by a simple check, as in the model before mentioned.

I am, &c.,
JAMES F. COLE.

5, Queen-square, Bloomsbury,
Feb. 24th, 1863.

SILICATE OF POTASH.

SIR,—I observed in your number of January 2nd a correspondent asking how to make silicate of potash, soluble in boiling water. He says he took 15 parts of quartz sand, and 10 parts of carbonate of potash, and 4 parts of charcoal in powder. Let him take 15 parts of carbonate of potash, and 6 or 10 parts of sand, bearing in mind that the less sand the more soluble will be the compound.

I am, &c.,
G. C. P.

Gossip.

A new system practised in armour-plating the ships of the French navy has been introduced, which it is expected will have the effect of warding off the dry rot, and preventing decay. It is effected by carbonizing with a flame of gas the surface of the timber before receiving the plates. In order to obtain a satisfactory test of the effect of this system, an equal number of the plates has been laid on without the carbonizing, and the system will be applied to the remainder of the strakes to obtain the necessary result.

On Saturday last a very magnificent screw steamer was launched from Messrs. C. and W. Earle and Company's shipbuilding yard, at the Victoria Dock, Hull. At the moment of taking the water the vessel was named the "Lotus." She is intended for the Mediterranean trade, and is owned by Messrs. J. Moss and Company, Liverpool. The registered tonnage of the "Lotus" is 500 tons; her actual burden, however, will be about 800 tons, and her dimensions are: length over all, 220 ft.; breadth, 21 ft.; and depth, 15 ft. 2 in. The launch was a very successful one, and the vessel presented a very graceful appearance on the water. Messrs. Earle and Co. have two other large steamers on the stocks, and two others will be laid down shortly. Messrs. Martin Samuelson, iron shipbuilders, are also doing a considerable trade. They have at present four large vessels in course of construction, and others will be laid down as soon as these are turned out.

His Royal Highness the Prince of Wales has intimated, through General Knollys, "his great pleasure in becoming the Vice-Patron of the Royal National Lifeboat Institution; and in contributing a donation of £30 for the purposes of the institution."

A company has been formed for the purchase of Messrs. Perrin and Delmas' patent (adapted to revolvers and cartridges) for which the prize medal of the International Exhibition, 1862, was awarded; and also for the manufacturing of modern improvements in firearms, and the adaptation of the patent to carbines and rifles. Prospectuses, and forms of application for shares, may be obtained at the temporary offices of the company, No. 3, Sun-court, Cornhill, and of the brokers.

Nine spots of different forms and sizes are now to be seen on the sun's disc.

The "Montauk," one of the "Monitor" ironclads, was lately in action, near Savannah, and used her 15-inch guns for some time. The Confederate work, however, was so massive that not even these tremendous projectiles were able to damage it. The range was long—600 yards. The "Montauk" was struck repeatedly by heavy shot from the rebel guns, but was not injured or caused to desist in her attack by them.

Messrs. Palmer Brothers, of Jarrow, have no less than 20,000 tons of iron shipping on hand. One of these vessels, a screw steamer of 2,686 tons burden, will be launched in a fortnight; the others are in various stages of progress. The ship nearly ready for launching is the "Georgia." She is one of ten which Messrs. Palmer are commissioned to build for Messrs. Fernie Brothers, of Liverpool, and which are meant to bring cotton from New Orleans. Another clipper ship of 1,100 tons is being built for Australia; and other four are for the Mediterranean; one of them will be 1,500 tons, and the others 900 tons each. Three of these are for a London firm, and one for a house in Genoa. A screw steamship of 2,000 tons is building for Messrs. Wilson, Chambers, and Co., Liverpool, and will form one of the White Star fleet trading to Australia. The other vessels are principally building for the coasting trade.

DRILL YOUR CENTRES.—If machinists, and others in the habit of using engine lathes, says a contemporary, only knew how much time and trouble are saved by the simple practice of drilling a centre, they would never omit it when about to turn a shaft. In the first place, to make a centre with a centre punch is to be guilty of a very unmechanical proceeding; the centre in work to be turned should be round and true; it ought also to conform to the shape of the dead or live centre of the tool which it is to be turned in. This feature cannot be obtained with a centre punch. The latter are always ground up to a sharp point on a stone, and are more apt to be triangular, than cylindrical in shape. Notwithstanding all these bad features, the punch is employed with the utmost confidence by a great many mechanics—by far too many—as a substitute for the drill. "It takes too long to drill the centre," says Shiftless, and then whack goes the hammer, and a three-sided conical kind of a cavity is indented into the shaft, and the clumsy workman proceeds to turn it down. In all probability he does not get two inches in length on it, before the work comes leaping out of the lathe and lies in the bed a faithful witness of his want of skill and forethought; the result is that the centre has to be renewed and the shaft runs out of truth. Now how much better it would have been to have drilled the shaft at once, and so made a perfect job—one that would last. Very often work goes out of the machine-shop and comes back again to be done over, because the person for whom it was made did not know what he wanted; or for other reasons, then the utility of a drilled centre is fully apparent, as the shaft may be put in the lathe and it will run true, whereas in a centre made with a punch there is no reliance of any kind to be placed. Again we say, then, drill your centres!

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 2139, 2145, 2159.
BOILERS AND FURNACES—*none.*
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2141, 2156, 2158
SHIPS AND BOATS, including their fittings, 2128, 2129.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 2160.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2134, 2138.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2137, 2142, 2155, 2162, 2163.
BUILDINGS AND BUILDING MATERIALS, 2157, 2164.
LIGHTING, HEATING, AND VENTILATING, 2127, 2133, 2140, 2143, 2148, 2150, 2154, 2165, 2170.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2144, 2147, 2151, 2161. 2167, 2168.
METALS, including apparatus for their manufacture, 2166, 2171.
CHEMISTRY AND PHOTOGRAPHY, 2130, 2132, 2133.
ELECTRICAL APPARATUS, 2131, 2153.
WARFARE, 2149.
LETTER-PRESS PRINTING, 2152.
MISCELLANEOUS, 2125, 2135, 2146, 2169.

2126. R. LOW and W. DUFF. *Improvements in apparatus or means for producing an adjustable pressure on certain parts of machinery.* Dated July 26, 1862.

This refers to the pressing rollers of machinery for spinning flax. A knee piece is attached to or cast in one with the grate or serrated bar, which extends over the wooden rollers in front of the drawing rollers. This knee piece is curved in a downward direction, and terminates in an eye which is screwed internally. To this eye is fitted a tube, screwed externally to correspond to the eye, and terminating at one extremity in a hand wheel or cross head, by which the tube may be screwed more or less through the eye. Inside the tube is placed a series of discs, or a piece of india-rubber, in front of which is fitted a metal plug which slides to and fro in the tube. The end of this plug extends out beyond the containing tube, its extremity being hollowed so as to fit the arbor or spindle of the contiguous wood roller. By screwing the tube into the eye, the end of the sliding plug piece may be caused to bear with any required degree of pressure on the wood roller, and as this roller drives the drawing roller by frictional contact therewith, the pressure of the one is imparted to the other. In this way any required degree of pressure may be obtained with great ease and certainty, at the same time dispensing with the use of levers, weights, and other complicated details. *Patent completed.*

2127. J. WALTON and J. MOORE. *Improvements in the mode of ventilating and heating rooms, Turkish baths, hothouses, and buildings of all kinds.* Dated July 28, 1862.

This invention consists of two parts, which may be used separately or together, for ventilating and heating rooms, carriages, huts, and buildings of all kinds. When required to heat buildings, the patentees generally combine the heating arrangements with the arrangements for ventilation. The apparatus for carrying off vitiated air from a room or other building is placed at the ceiling or upper part of the room or building, and is composed of a conical tube, the larger and lower end of which opens into the room, and the smaller end either opens directly into the outer atmosphere, or communicates with it by a pipe. Through this conical tube the vitiated air escapes from the room or building. Around the conical pipe is a cylindrical pipe of larger diameter than the bottom of the conical pipe, so that there is an annular space between the bottom of the conical pipe and the bottom of the cylindrical pipe. The upper end of the cylindrical pipe also communicates with the outer atmosphere, and as vitiated air passes away from the room through the conical pipe, fresh air enters the room through the space between the bottom of the conical pipe and the bottom of the cylindrical pipe. In order to supply a room, Turkish bath, or other building with heated air, the following arrangement is employed:—Above a fireplace or furnace is formed an air chamber, the bottom of which is heated by the fire, and is formed of fire bricks or tiles—by preference, the fire-bricks made of pipe clay. Air is admitted into this chamber from other chambers formed at the sides of the fireplace or furnace, air being admitted into the front of those chambers from the outer atmosphere; the heated air passes away from the back of the chamber above the fireplace through a passage or flue, which conducts it into the Turkish bath, or into the room or building to be heated, the passage or flue being, by preference, conducted beneath the floor of the bath or building, and openings or gratings are formed in the top of the flue to permit the heated air to enter the bath or building. Beneath this hot air flue is conducted the smoke flue of the fireplace or furnace, so that the air in the air flue is kept heated by the smoke flue, and the top of the smoke flue, which also forms the bottom of the hot air flue, is, by preference, formed of the fire-brick or tile above mentioned. A large body of air will thus be heated and allowed to enter the room or building, but no portion of the air will at any time be so highly heated as to partially burn or decompose it, and thus render it injurious to animal life. *Patent completed.*

2128. H. Bollinger. *Improvements in machines employed in ship building, parts of which are also applicable to other purposes.* Dated July 28, 1862.

This invention consists, first, in an improved cutting machine for cutting off the ends of angle iron or other shaped bars, but chiefly intended for cutting off the curved ends of ships' frames. Secondly, in an improved blowing machine for working blast and other furnaces. Thirdly, in improvements in rivetting machines for rivetting the beams and ribs of ships, and other parts which can be rivetted up before putting them in their places, and also for rivetting marine and other boilers, bridges, and metal girders. Fourthly, in an improved universal slotting and drilling machine, either portable or stationary. And fifthly, in an improved double acting shaping machine, with revolving cutters to be used in constructing vessels, and also the machines before mentioned. *Patent completed.*

2129. C. W. Eddy. *Impeding a channel against the entrance of ships and vessels, and in particular of screw ships.* Dated July 28, 1862.

In carrying out this invention, the inventor constructs several nets of rope, and in particular some of coir or Manilla rope, or of other light material, which will float horizontally on, or a little below, the surface of the water, without the aid of buoys, or at least with but little aid from them. He places these nets across or partially across the channel to be impeded, where they may be secured by anchors or other fastenings. And he proposes that, when the nets are required to be of considerable length, they may be manufactured in squares, which may be towed separately to their proper positions, and there laced together, the whole thus forming one net or system of network. *Patent abandoned.*

2130. W. Spence. *Improvements in the preparation of a red colouring matter.* (A communication.) Dated July 28, 1862.

This invention has for its object, in the first place, the transformation of phenic or carbolic acid into a red colouring matter. Secondly, the transformation of this matter into a fast colouring matter, capable of resisting the action of acids and other agents. And thirdly, the application of this substance to dyeing and printing. The colouring matter is first prepared thus:—The inventor takes about 23 lbs. of phenic or carbolic acid, from about 10 to 20 lbs. of oxalic acid, and from about 7 to 14 lbs. of sulphuric acid. This mixture is heated until the colouring matter is formed of the requisite colour and consistence. When this operation is considered to be finished, the matter is washed with boiling water, in order to remove the excess of acid. It is then in the state of a light pitch, and with a green shade of cantharide. It may be dried and reduced to powder by means of heat, or by a longer process without heat. The matter thus produced is converted into more solid matter by the following process:—The inventor takes about 2¼ lbs. of this less solid matter, and about 5½ lbs. of ammonia of commerce. This mixture is put into a closed metallic vessel, then heated to a temperature of about 270 deg. Fahr. for about three hours. This is allowed to cool, and then the vessel is opened. The matter originally introduced therein becomes completely dissolved in the ammonia, thence yielding a liquor rather thick, and possessed of a considerable colouring matter. This liquor when heated by acids furnishes a deep red precipitate, which is the fast colouring matter modified as required, and which is capable of dyeing red silk, wool, and other textile materials. The matter thus prepared is called "peonine," and is applicable to dyeing and printing generally. *Patent completed.*

2131. P. S. Devlan. *Certain improvements in the manufacture of telegraphic cables.* Dated July 28, 1862.

The cable constructed according to this invention consists of a number of insulated wires, collected and arranged together to form the cable, and is designed for the purposes of flexibility, durability, tenacity, and strength. The improvement consists in coating the wires to be insulated with a composition consisting of about 8 lbs. of paper, or other fibrous pulp, half a pound of caoutchouc or gutta percha, with 1 lb. of resin, or thereabouts. The composition is thus applied. The inventor takes one or more of the ordinary conducting wires, over which he puts a complete coating of the composition in any required thickness; this coating of the composition is put on while the latter is in a soft condition, and may be applied by suitable dies or drawing machines for the purpose. When the coating has become sufficiently dry, he braids or plaits over it a coating of fine strong cord; over this covering of cord he applies another coating of the composition, and over it another cord covering, and so on until the cable is completed. *Patent abandoned.*

2132. W. Spence. *Improvements in the preparation of a blue colouring matter.* (A communication.) Dated July 28, 1862.

For the purposes of this invention, there are taken about five parts of the matter which has been called "peonine" in the specification of a patent granted to the present patentee as a communication from abroad (No. 2130) in the year 1862, and described therein as a red colouring matter prepared from phenic or carbolic acid, and from about 6 to 8 parts of aniline. The mixture is heated to a temperature near to the boiling point, which heating is maintained for some hours, until the material is completely transformed. The result hence obtained is a blue colouring matter, which is purified by successive washings; first, with boiling water acidulated with sulphuric, hydrochloric, or other acids; secondly, with heated coil oil; and thirdly, with a dilute solution of caustic, soda, or potash, or other alkalies. The matter thus obtained is passed into acidulated boiling water, then dried. It is then in a state of powder, with golden shades soluble in alcohol, methyle, and other spirits, and the solutions of which may be used directly for dyeing and printing. The colouring matter thus obtained is called azuline, and is applicable to dyeing and printing generally. *Patent completed.*

2133. P. A. Favrichon. *An apparatus for the speedy and economical heating of baking ovens, and also for using the excess of heat, which is called "Oven of Valfort and Favrichon, Bros."* Dated July 28, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2134. W. Maugham. *Improvements in the manufacture of effervescent beverages.* Dated July 28, 1862.

In accordance with this invention, the patentee dissolves phosphate of soda, preferring that commonly called phosphate or rhombic phosphate of soda, at the rate of six drams troy to half a pint of water; and to render this liquor aerated it is only necessary to pass it into a sufficiently strong and properly closed vessel, and then to charge it with carbonic acid gas, under a sufficient degree of pressure, which may be varied so as to be greater or less, at the will of the manufacturer. *Patent completed.*

2135. T. Cooke. *Improvements in apparatus employed in the manufacture of envelopes.* Dated July 28, 1862.

For the purposes of this invention a sliding table is used, carrying two die boxes, and the sliding table is arranged and worked in such manner as to be moved to and fro upon a stationary table, in order to bring the two die boxes alternately under a plunger. The plunger descends twice into each die box; at the first descent it creases the envelope paper by pressing it into the die box, and at the second it folds in the flaps. After the paper has been creased the flaps are folded inwards by means of levers or instruments working inside the plunger. When the plunger is at the top of the stroke the levers project below the plunger, and extend beyond its sides, so that, in the second descent of the plunger, they catch the ends of the flaps of the envelope paper, which are projecting above the die box, and carry them inwards under the plunger, which then completes the folding of the envelope. After the plunger has risen for the second time the sliding table is moved a distance equal to that required to bring the other die box (covered by a piece of envelope paper) under the plunger. This movement of the sliding table also brings the die box in which an envelope has just been completed into a position beyond the stationary table, which enables it to discharge such envelope into a proper receiver. A fresh piece of envelope paper is then placed over this die box, which will in turn be carried by the die box under the plunger, when the sliding table is again moved. By these means envelope paper will be folded in the die boxes when they are alternately brought under the plunger. *Patent completed.*

2136. A. Noble. *Improvements in obtaining and treating compounds of alumina.* Dated July 28, 1862.

One portion of this invention is carried out as follows:—In order to obtain a preparation of alumina, which, for many purposes, may be used as a substitute for alum, the patentee takes clay, or material containing variable quantities of alumina oxide of iron and water, and treats it with hydro-chloric acid in the following manner:—He takes the clay, or other material, and after having ground it to a fine powder, and calcined it in a reverberatory furnace at a low red heat, he exposes it to the action of hydro-chloric acid gas, which is taken as it comes from the furnaces in the ordinary plan of making salt cake; or it may be obtained in any other convenient way, care being taken that the temperature of the gas is somewhere above 200 deg. Fahr. If the temperature is too high, no action will take place, and, if too low, the compound will become partly liquified. When the operation has been successfully performed, the resulting substance, which he calls crude chlor alum, is in a dry state; it consists of a mixture of chloride of aluminum, with some chloride of iron, silica, water, and other substances. The apparatus the patentee finds suitable for carrying on this operation consists of a chamber built of sandstone, fire brick, or other material little acted on by hydrochloric acid, and furnished with shelves of the same material, arranged in such a manner that the current of hydrochloric acid gas shall circulate over each. The prepared clay is thinly spread (say, in layers from 1 to 2 in. in thickness) on these shelves. A good plan is to place the chamber in such a position that the hydrochloric acid gas can pass through the chamber on its passage from salt cake furnaces to the usual condensing powers, so that all the hydrochloric acid gas not absorbed by the clay passes on to the tower, and it is condensed in the usual way. *Patent completed.*

2137. J. Fourdrinier. *Improvements in apparatus for removing knots from pulp.* Dated July 28, 1862.

For the purposes of this invention an upright cylinder is used, the periphery or circumference of which is formed with numerous upright slits of the form and character of those used in other knotting apparatus. This cylinder is placed within another cylinder, or vat, from which the pulp is conveyed to a paper-making machine. Within the first-mentioned, or inner cylinder, a rotating apparatus is applied, in order that the pulp, which is continually fed into the interior of the cover, may be continually dashed, thrown, or projected against the inner surface of the cylinder, and thus caused to pass through the slits, or openings, formed thereon into the outer cylinder, or vat, whilst the knots are retained within the inner cylinder. *Patent abandoned.*

2138. J. Ellis. *Improvements in apparatus for washing corn and other grain.* Dated July 28, 1862.

This invention consists of machinery, or apparatus, arranged and working as hereinafter described. Overhead is a feed hopper, with a regulator at bottom, to make the outlet larger or smaller, as may be desired. The grain falls from this hopper into a chamber with an inclined perforated bottom, where it is stirred by agitators on a revolving shaft, and worked down the incline into a perforated inclined cylinder, where it is acted upon by brushes on a revolving shaft. The grain is worked to the lower end of the inclined cylinder, and falls into a receiver, from whence it is elevated by an endless chain carrying buckets, and discharged from the buckets into any desired receiver. Under the inclined chamber and cylinder are V shaped troughs, fitted with valves, or taps, at bottom, opening into an inclined channel common to all the troughs, from which the dirt separated and washed out from the grain is run off. There is also a valve fitted to the further end of the chamber, into which the grain falls from the inclined cylinder. Steam, hand, or other power, may be used to drive the apparatus. *Patent abandoned.*

2139. F. Selby. *Improvements in surface condensers.* Dated July 28, 1862.

This invention was described and illustrated at page 89 of the present volume of this journal. *Patent completed.*

2140. H. Hedgeley. *Improvements in lamps.* Dated July 28, 1862.

The first part of this invention relates to lamps known as moderators, and consists of certain improvements in the means of overflow of the oil, by the adoption of which moderator lamps may be made to burn paraffin or other mineral oil without any exposure of the oil. The patentee forms a burner of a particular shape, consisting of two and three tubes, the inner tube to hold the wick; the second tube to form a case and overflow; the outer or third tube to cover all in, and prevent evaporation or effluvium from the oil in its flow, And in order to obtain perfect combustion, he uses, in lieu of a cone, an oxydation glass or chimney, of a certain shape (as shown in the drawing). He forms slots or apertures on each side of the wick holder; or in lieu thereof a series of small openings at any desired distance below the top. Through these apertures the excess of air will flow, instead of continuing its upward course to the top of the wick tube. Or in lieu thereof, he uses a short overflow tube, and places a fixed cap thereon to form the requisite continuation of the burner. The oil will thus flow down the exterior of the holder, and within an outer casing or cylinder, which is to be screwed or fixed around the holder. This outer casing is to be fitted so as to exclude the air, and thus to completely confine the oil and prevent its evaporation. The oil will pass through suitable orifices down either one or two tubes into the reservoir of the lamp, and may be again pumped upwards. The patentee effects improvements in plungers of moderator lamps, in order to render them more effective in maintaining mineral oils below the said plungers, by making the plunges of metal nearly the diameter of the cylinder, the centre thereof being raised into a dome, and by attaching a ring of leather, the lower part of which ring expands and fills up the intervening space between the plunger and cylinder. The second part of the invention refers to lamps or chandeliers where the oil is contained above or at the level of the light. He causes the oil to flow from the said reservoir through arms or pipes to the burner, which burner is above the overflow. The tubes are made in the same way as in the former instance, the rack spring and plunger being dispensed with, as the oil ascends by hydrostatic pressure to a certain level, and then by capillary attraction. *Patent completed.*

2141. E. Burnet. *An improved combined cart and sleigh.* Dated July 28, 1862.

This invention consists of a novel construction of vehicle forming a combined cart sleigh. The shafts are jointed by a hinge to the cart or sleigh, and at a short distance from the joints underneath each shaft a curved branch or arm of iron descends, forming a connecting stay, which is attached to a flat spring extending across the under part of the boot, to which it is attached by bolts, screws, or other fastening. The curved arms are hinged at a short distance from their attachment to the shafts, in order to allow the shaft points to descend to the ground when the cart is not in use, and also to prevent fracture or other damage to the shafts or cart in the event of the horse falling. This arrangement also relieves the shafts of much weight and strain. The springs are formed of elliptical bars or plates, and only consist of four plates presenting the appearance of a small spring inside a larger one, with which it is only connected at the upper and lower bearing surfaces of the cart and axle. The seats are made to hold four persons who sit back to back: the front seat is adjustable, and can be shifted backwards when only two persons are to ride, so as to cause the cart to balance as when four persons are riding. When the wheels are removed, as well as the iron feet on which the cart falls forward and bears on the ground when not in use, the body can be attached to a sleigh frame, and be used in winter as a sleigh with all the advantages of the spring shafts before described. *Patent completed.*

2142. J. L. Jullion. *An improvement in antichloride for paper working.* Dated July 28, 1862.

Provisional protection has not been allowed for this invention.

2143. C. W. Siemens. *Improvements in gas engines.* Dated July 28, 1862.

This invention has reference to that class of engines in which motive power is obtained by the expansive action resulting from the combustion of a mixture of an inflammable gas, or of inflammable gases or vapours, and atmospheric air within a closed chamber or cylinder. One part of the invention consists in certain improved means of igniting the mixed gases and atmospheric air as they enter the combustion chamber or cylinder. Another part of the invention has reference to the mode of admitting the combustible gases and air into the working cylinder, and of discharging the products of combustion therefrom after expansion. Another part of the invention consists in certain improved means for preventing the destruction of the reservoir through an accidental explosion of the combustible gas and air, when these are contained therein in the form of an explosive mixture. *Patent abandoned.*

2144. R. Thompson. *A new and useful improvement in lock stitch sewing machines.* Dated July 28, 1862.

This consists, 1. In making the packing-box in which the hook revolves of raw hide, cloth, felt. 2. In constructing the moveable bobbin case with a start upon its outer end, for revolving the said case with the hook, and also to act as a cast-off for the thread when the point of the hook has entered the loop formed by the needle. 3. In making the body of the start elastic, and so attaching it to the bobbin case as to spring out a little from it, in order that the said case when placed in the hook may be prevented from working out by the friction of the elastic start. 4. In the use of a spring on one side of the hole in the hook, and a screw passing from the outside of the hook against the said spring, whereby the tension of the bobbin thread can be regulated without the removal of the bobbin or its case. *Patent completed.*

2145. Z. Colburn. *Improvements in steam engines.* Dated July 29, 1862.

We cannot here devote space to the details of this invention. *Patent completed.*

2146. J. Mackenzie. *Improvements in shaping machines for curvilinear surfaces.* Dated July 29, 1862.

This machine has the ordinary frame used for planing and shaping machines. The cutters are fixed on the cutter block in the usual manner; the latter—that is the cutter block—is mounted upon an axle or spindle, either by being keyed to it, or forged with it, which is driven by bevel gearing. This bevel gearing is in this case of great importance, as it allows of the spindle and cutter block having an angular motion in a vertical plane given to it (this angular motion is the improvement claimed.) The inventor gives this angular motion to the well known boring and shaping spindle and cutter by making it move round an axis in the body of the frame, which axis being in a line with that of the shaft carrying the driving bevel wheel, the "gearing" cannot be interfered with, although the spindle should be made to move round a circle. The angular motion is regulated by the well known quadrant and endless screw so much used in other similar cases. In fact, the inventor takes the ordinary boring machine with its traversing saddle, and causes its spindle to take an angular motion in the manner described, instead of always remaining vertical as now made. The ordinary machine, with its cutter block always vertical, can only plane at one angle, whereas by this improvement the metal can be shaped to any angle, varying or uniform. *Patent abandoned.*

2147. A. Boyle and T. Warwick. *Improvements in the manufacture of the ribs and stretchers of umbrellas and parasols, and in machinery to be employed in the said manufacture.* Dated July 29, 1862.

These improvements in the manufacture of the ribs of umbrellas and parasols are effected by means of rolls in grooves in the peripheries, or cylindrical surfaces, of which suitably formed dies are inserted. The improvements in the manufacture of the stretchers of umbrellas and parasols may be effected either by the use of dies fixed in the rolls, or partly by the use of dies worked in a stamp or press. *Patent completed.*

2148. E. T. Hughes. *An improved process of refining the slag from blast, puddling, and other furnaces, and in the employment of the refined material for mortar, stones, slabs, ornaments, and other similar articles.* (A communication.) Dated July 29, 1862.

The patentee claims, 1, The improved system of changing the slag flowing in a glowing condition out of the blast, puddling, and other furnaces, by a rapid and complete covering with water, or any other steam developing fluid. 2, The application of the slag prepared for the manufacture of mortar, and also with the admixture of lime, or cement, for the manufacture of bricks, stones, slabs, ornaments, and other such-like articles. *Patent completed.*

2149. P. S. Devlan. *An improved composition to be employed for covering projectiles and the internal and external surfaces of vessels, which is also applicable to the manufacture of tubing, and to other useful and ornamental purposes.* Dated July 29, 1862.

This invention consists in an admixture and combination of paper, or other fibrous pulp, caoutchouc, or gutta percha, and any resinous gum; plumbago, may, also, if required, be mixed therewith. The proportions the inventor prefers are about 8 lbs. of fibrous pulp to half-a-pound of caoutchouc, or gutta percha, and 1 lb. of resinous gum, although such proportions may be varied without materially differing in effect. *Patent abandoned.*

2150. J. Norris. *Improvements in the arrangement or construction of ovens.* Dated July 29, 1862.

For the purposes of this invention, at the lower part of and supported within the chamber of the oven (which may be formed of brick work, or other suitable material, with air spaces, to prevent radiation of heat), a narrow space, or chamber is formed, the upper surface of which constitutes the bottom of the oven, and encloses the upper part of the furnace, or fireplace, formed by deepening the lower part of the narrow chamber near the centre to receive the fuel for the purpose of heating the oven. This chamber is made, by preference, of cast iron, either in one piece, or cast in plates, tubes, or other suitable forms, and the part in contact with the fire may be protected by fire bricks or tiles. At the ends, centre, or other part of the upper surface of the chamber over the furnace, or fireplace, narrow slots, or openings, are formed, from or near the front towards the back of the oven. These openings communicate with passages, or flues, which rise up, and are continued over the top of the oven, forming a narrow chamber, or flue, at the upper part thereof, from which the heat and products of combustion pass away by a suitable-flue, regulated by a damper, which flue, if desired, may be arranged to impart heat to water, or for other purposes. Thus it will be seen that the flues which rise from the closed chamber over the fireplace, or furnace, form the oven into two or more compartments, in which the articles to be baked, cooked, heated, or dried, may be placed upon shelves, or otherwise. A narrow air space is left between the flues forming the oven, as above described, and the inner sides of the chamber in which it is supported, suitable apertures being arranged for the introduction of air when required. Where several ovens of large dimensions are required to be fixed in one "setting," two or more fireplaces may be employed for heating the same if desired. *Patent completed.*

2151. C. T. Burgess. *An improved stand for beer and other casks.* Dated July 29, 1862.

This invention consists in constructing a stand for beer and other casks, in which the cask is made to tilt gradually forward with the decrease of the liquid in the cask. The stand consists of two parts:—The first is a pillar or frame for supporting a cradle in which the cask is placed. This cradle is a semi-circular frame, with flanges projecting from the upper and outer sides. The bearing surface of these flanges is curved or cam-shaped, and the flanges rest upon flat surfaces on the top of the frames. A bar projects forward from the semi-circular frame, which is bent up at front to receive one of the ends of the casks. In some cases, however, the patentee dispenses with the projecting bar. *Patent completed.*

2152. G. Waldie. *Improvements in colour printing.* Dated July 29, 1862.

This invention relates to a new system of colour printing, which is applicable to letter-press printing, lithography, calico printing, and to the printing of paper hangings. Under one modification, as applied to letter-press printing, as, for example, show bills, and other work, printed in straight lines, the several lines of type or ornament may be inked at one operation, with inks of various colours, and so produce with one printing an impression in several colours, which, in the ordinary way, would require several impressions in succession to produce. According to this modification the inking table over which the inking roller is passed is divided into longitudinal divisions, and the roller is guided by end flanges, so that the same part of the periphery of the inking roller always passes over the same division of the table. The divisions of the table are made to correspond to the width of the surfaces of the lines to be printed, or any other convenient width, and they are separated by grooves or spaces, so that the different colours cannot get mixed on the table or run together. *Patent abandoned.*

2153. J. Mapple. *Improvements in telegraphic apparatus.* Dated July 29, 1862.

This invention consists of a flat endless chain, known as a clock or watch chain, rotated by a train of clockwork, and the said flat chain is made to rub against an inking-roller supplied with common printing ink, and the strip of paper is made to press against the inked surface of the chain by the attractive force of an electro-magnet, and by these means the telegrams are traced in ink in lieu of indentations produced by the common Morse instrument. *Patent abandoned.*

2154. E. B. Clark. *Improvements in the manufacture of candles.* Dated July 29, 1862.

In carrying out this invention, the inventor proposes, instead of the ordinary mode of dipping, to place the tallow, or other material suitable for the manufacture of candles, in a cold or partly cold state, within a covered trough or receptacle, placed upon a suitable framing; one end of this trough or receptacle is open, and is provided with a corresponding block, across which is a series of holes, to which are secured polished metal dies of the required diameter of the candle. A bar is placed behind and across the block, within the trough, in the front of which bar wires are fixed, which pass through the centres of the dies. About the middle of the trough, and fitting closely thereto, is placed a plunger, which is caused to move towards the dies by means of racks and pinions attached to the back of the plunger within the opposite end of the trough: thus, when motion is imparted to the pinions by winch handles outside the trough, the tallow or other material contained therein is forced against the dies, and in passing through them is formed by means of the centre wires into hollow candles or tubes, which are then to be cut off at certain distances, as required, by a cutter or cutters working in front of the dies, or in a groove formed in the block near the mouth of the dies. The wicks of such candles are to be drawn through in a dry or partially dry state by means of wires. *Patent abandoned.*

2155. M. Henry. *Improvements in obtaining fibrous materials and paper pulp, in treating, cleansing, and scouring fibrous materials and fabrics manufactured thereof, in producing soap for the same operations, and in obtaining products from liquors used therein.* (A communication.) Dated July 29, 1862.

This invedtion has for one object the manufacture and application of an improved soap, suitable for employment in obtaining fibrous materials and paper pulp from plants, and in scouring, bleaching, improving (as to quality and appearance) and treating fibrous and textile materials and fabrics manufactured thereof. The aforesaid improved soap (herein called caustic soap) is produced by combining caustic alkalies in considerable proportions with saponifiable materials, or materials capable of saponifying, the alkalies being used in such large proportions that they become unable to dissolve, destroy, or injure animal or vegetable textile fibres, while, nevertheless, retaining their disintegrating power, that is say, their power of setting free or separating the fibres from the other extraneous matters combined therewith or adherent thereto. This caustic soap is manufactured by combining a concentrated solution of caustic alkali with a saponifiable material in a fluid state, and then stirring or agitating the mixture, and leaving it to stand or at rest. Resinous bodies and essences may be used in the manufacture of the caustic soap by dissolving them in the alkali before adding the other or saponifiable ingredient. In manufacturing the caustic soap for treating any particular plant, an oil or fat obtainable from that plant may be combined with the alkali. We cannot give space to all the details of the invention. *Patent completed.*

2156. G. Nock. *A new or improved safety or moveable self-acting crossing for railways.* (A communication.) Dated July 30, 1862.

In the crossing for railways ordinarily employed, the ends of the rails on either side the crossing point or frog are fixed. In this invention the ends of the rails are made moveable, that is, they have a slight motion about a centre or point at the chair, six feet, more or less, distant from the ends of the rails. The two ends of the rails are clipped and bolted together to suit the curve of the road, and sufficient play is left in the chair and in the holes through which the spikes pass to allow of the slight motion required. When the flange of the carriage wheel comes in contact with the guard rail, the carriage wheel on the crossing point or frog presses the moveable rails outwards, to accommodate the curve of the line. The periphery of the wheel thereby obtains a greater bearing, and the crossing points wear much longer than crossing points of the ordinary construction. The motion of the engine and carriage is very steady, and the passing from one line to another is not attended with the jarring motion which occurs when the ordinary crossing point is employed. The said new safety or moveable self-acting crossing is much safer than an ordinary crossing point. *Patent completed.*

2157. F. C. Warlich. *Improvements in machinery for dressing and shaping stone.* (A communication.) Dated July 30, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2158. W. E. Gedge. *Improved means or apparatus for securing the safety of trains moving on railways.* (A communication.) Dated July 30, 1862.

The object of this invention is to prevent the rolling stock forming a railway train from leaving the rails during its locomotion. This object is attained by bringing into use, either on the permanent way of railways or on the vehicles used thereon, one or other, or a combination of several or all of the improvements hereinafter described, the first described being the most perfect, the second the most economical. The most usual causes of railway accidents are: 1, The severity of the curves. 2, Breakage of axles. 3, The mode of breaking, which, in stopping entirely the rotation of the wheels, causes them to slide on the rails, thus wearing them at a given point, and rupturing the integrity of the circle or crown of the rail, causing jerking or jumping on the rail, and subsequent possible breakage of axle, or departure from the line of rail. The apparatus forming the first part of these improved means for securing the safety of trains moving on railways may be divided into three principal parts. 1, A third or safety rail. 2, Two friction rollers turning horizontally on each side of the safety rail. 3, Of two nipples, chimneys, or trivets, forming boss or name to the axles of the friction rollers. And, first, as regards the third or safety rail which is laid down on wooden sleepers at curves (or other dangerous parts of the permanent way) between the ordinary rails, and is elevated slightly above them. Near the extremities, and to permit the introduction of the flange of the rollers, it has its lateral faces brought nearer together, giving to the rail at its spring the shape of a wedge, or the upper shoulder may gradually die away. The safety rail starts before the curve begins, in order that the train may travel on it before the locomotive arrives at the curve; or it may be used along the whole line of railway (except at crossings) if found desirable. In the second means (heretofore alluded to), the centre or safety rail is dispensed with, a modification being made in the ordinary rails by which the wheels of the carriage, and the base or block of the safety brake, are made to rest on a return provided with a shoulder, which fulfils the office of the safety rail before mentioned. The invention cannot be described in detail without reference to the drawings. *Patent completed.*

2159. J. and J. Hyde. *Certain improvements in governors for steam-engines, water wheels, mills, and for other similar purposes.* Dated July 30, 1862.

This invention is designed for the purpose of insuring the slightest alteration of the governor being transferred to the steam supply valve, and thus to render the governor more positive and sensitive in its action, and prevent inaccuracy from the adhesion or friction of any part. The improvement consists in the application and use of a train of gearing interposed between the governor and the steam valve for the above purpose. Upon the vertical shaft driving the governor a pinion is fixed, gearing with another pinion, which drives a shaft actuating bevel gearing, and a double catch-box, which is connected and disconnected by the movement of the ordinary lever acted upon by the governor. These upper or lower catches being thrown in or out of gear regulates the admission of the steam by opening or closing the steam supply valve. *Patent abandoned.*

2160. B. Bailey. *Improvements in means or apparatus for cutting chaff and other vegetable matters, which improvements are also applicable to cutting or mowing short or lawn grass.* Dated July 30, 1862.

This invention relates to arranging and supporting the cutters in apparatus commonly called chaff-cutting machines. The patentee employs a pair of cutting blades supported by ribs or arms from a central axis in front of the mouth of the trough supporting the matters to be cut, and in such manner that all parts of the cutters are concentric or nearly so to such axis, whilst the cutting edges are inclined diagonally thereto, but in opposite directions one to the other, so that, when caused to revolve, one cutting edge will begin its cut at one end thereof, and finish at the opposite, and supposing this to be from right to left, the other cutter will begin at the left, and progressively cut to the right. These diagonal cutters act with a fixed cutter forming part of the feed mouth. The cutters are adjustable, and the parts between them are open to admit of the free passage of the matter cut. This arrangement of cutters is also applicable to lawn mowing machines. *Patent completed.*

2161. H. White. *Improvements in shirt collars.* Dated July 30, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2162. W. Wanklyn. *Improvements in apparatus for opening and conditioning East Indian and other tightly-compressed cottons.* Dated July 30, 1862.

This consists in improved apparatus for opening and conditioning, or bringing into a condition suited for the processes of preparing and spinning, East Indian and other cottons that have been packed in compressed bales. In performing the invention the patentee makes use of a steaming chamber. The chamber which he uses, by preference, is snpported by trunnions, and has a perforated false bottom and a steam-tight lid, which is supended to a chain or cord and counterbalanced. Steam is admitted to the chamber by a pipe, in which is a tap, and the steam should be at a high pressure. He also uses a syphon or other suitable apparatus to the steam-pipe, to prevent the water of condensation entering the chamber with the steam, which he prefers to use in as dry a state as possible. The cotton, when taken out of the bale, is placed in the chamber, and when full, or nearly so, the lid is put on, and steam is admitted. As soon as the steam has had time to permeate and heat the cotton, the lid is removed, and the steam chamber is swivelled partly round on its trunnions to allow the cotton to be raked into a truck or other carriage, in which it is removed to the room in which the subsequent operation is to be performed. A tap is inserted in the steam chamber, under the false bottom, to discharge the water that may have accumulated there. *Patent completed.*

2163. J. Benyon. *Certain improvements in looms for weaving.* Dated July 30, 1862.

This relates to the taking-up motion, and consists in an improved arrangement of parts for giving a positive take-up motion to the roller on which the fabric is wound as it is delivered by the loom. The improved arrangement of parts may be applied to the warp beam to effect a positive let-off motion. *Patent completed.*

2164. G. H. Birkbeck. *Improvements in the means or processes employed for preserving timber from decay or destruction.* (A communication.) Dated July 30, 1862.

For the purposes of this invention a compound resembling soap is prepared by combining a solution of sulphur or metallic oxides, or both, combined with fatty acids, which are insoluble in water, but are readily dissolved in rough naphtha, or in American or Canadian petroleum, in the state in which it is obtained from the oil wells of those countries. The method which is preferred of preparing the compound consists in boiling "claine" or "magaric acids" (residual products obtained from the manufacture of stearine or other similar description of candles) with a metallic oxide. A little water is introduced into the vessel in which the mixture is boiled to form the salts, in order to prevent the decomposition of the fatty matters. The formation of the soapy compound is readily and quickly accomplished in an open metal vessel, the mass being constantly stirred or kept in motion. The soapy compound thus prepared is then dissolved in rough naptha or petroleum in a closed boiler (by preference, of wrought iron or copper) provided with a bent tube or worm, connected with an ordinary condensing apparatus, so that the fine naptha, which is distilled over by boiling the soap into the rough naptha or petroleum, is thus preserved, and is a valuable product resulting from the process. The solution thus prepared may be forced into the wood by pressure in various ways, as is well understood in impregnating timber with other solutions; or the timber may be impregnated by boiling it in the solution contained in a closed boiler. *Patent completed.*

2165. W. Clark. *Improvements in gas burners.* (A communication.) Dated July 30, 1862.

This relates to the application of a small cap or thimble of wire gauze to gas burners, ecpecially those called fish-tail burners, whereby to increase the lighting power for a given quantity of gas consumed, and, consequently, lead to great economy in its consumption. This cap will be found very efficacious, as it introduces a metallic body into the centre of the frame, which thus becomes heated, while it further counterbalances or regulates the initial pressure of the gas. *Patent completed.*

2166. T. Holt and F. L. Stott. *An improved composition or compositions for protecting polished surfaces of iron and steel against oxidation, and for renewing and improving the polish of such surfaces.* Dated July 30, 1862.

This consists in a combination of lime, oils, and fatty matters, camphor, and a solvent of camphor. The inventors prefer to use 40 parts of lime and 54 parts of lead, mutton suet or beef fat, 1 part of oil of cloves, 4 parts of camphor, and 1 part of turpentine. *Patent abandoned.*

2167. W. Norman. *Improvements in tables and drawers or other sliding receptacles.* Dated July 30, 1862.

This consists in the adaptation of metal bars to the framework of sliding tables, which bars are embraced by metal clips carried by a separate framing. These bars and clips, therefore, constitute mutual guides, so as to allow of an expansion of the table which is carried by the said framing, and the patentee adopts a similar method of construction for drawers, shelves, and other such like sliding receptacles. *Patent completed.*

2168. J. W. Dixon, jun. *Improvements in coffee urns.* Dated July 30, 1862.

Here the patentee takes a metal ring and covers it with muslin, and the muslin is held in its place by a second ring fitting with the first, and the fabric is nipped and held between the two. These two rings being thus put together, they are then fitted into an annular ridge at the bottom of the urn. To fix the muslin properly it is necessary to lay it down flat, then to place the first ring in the centre of it; the corners of the fabric are then turned in over it, and fixed in the inside ring. The second ring carries a strainer of perforated metal; this the patentee makes in the form of a flat plate or disc, which is soldered to the ring, and has a truncated cone also of perforated metal attached to it at the centre; and projecting upwards on this the coffee is placed, and boiling water being poured in it rapidly forms an infusion which can be drawn off by a tap at the lower part of the urn. *Patent completed.*

2169. J. W. Woodford. *Improvements in machinery for raising or forcing water.* Dated July 30, 1862.

Here a vertical shaft is used, which turns in suitable bearings above the case or cylinder hereafter mentioned. The lower end of the shaft is hollow, and it steps on to an upright fixed conical bearing by which the shaft is supported. The shaft receives motion from a steam-engine or other power, by a strap which acts on a drum or pulley on the shaft, such drum or pulley being arranged to be fixed in any required part of the shaft. At its lower end the shaft passes through a fixed case or cylinder, which has one, two, or more tangential outlets, with rising pipes fixed thereto; when the two tangential outlets are used, they are formed at opposite sides of the case or cylinder. On the lower end of the shaft are fixed two bent or curved arms, to which bent or curved plates or blades are fixed. These arms and the blades are curved back from where they spring from, or are affixed to the upright shaft. The upper cover of the case or cylinder is close, except where the shaft passes through it, whilst in the under cover there is a central opening for the passage of water into the interior of the case or cylinder. In constructing framing for this machine, four vertical angle irons are used, fixed at the four angles of the base plate to which the case or cylinder is affixed, and these angle irons are framed or stayed together at intervals. In order that such framing may be convenient for fixing and unfixing in places where the machine is to be used, it is preferred that the upright angle irons should be made of convenient lengths, and be arranged and formed conveniently for the ends thereof going together, and being fixed readily by screw bolts and nuts or otherwise. *Patent completed.*

2170. E. F. Prentiss and R. A. Robertson. *Improvements in obtaining products from rock oil, coal tar, and other like mineral substances in a more or less pure or deodorized state, and in the appuratus to be used therefor, and which is also applicable to distillation in general.* Dated July 31, 1862.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

2171. W. Weild. *Improvements in machines for cutting, shaping, rolling, drilling, screwing, milling, and fluting metals.* Dated July 31, 1862.

The first part of this invention consists in the arrangement of machinery for cutting, shaping, and rolling combined in one machine. This compound machine is more especially adapted for the manufacture of fire-box stays or bolts for locomotives and other boilers. The second part relates to an improved arrangement of machinery for screwing such stays in a most perfect and rapid manner, and it consists in giving rotary motion to three steel screwed rollers placed near to each other, and revolving in one direction. 3, In the arrangement and construction of a drilling machine with one or more drilling heads on one bed; each head has a separate and independent motion in a horizontal and lateral direction, and also an independent rotary and vertical section of the drill. 4, In certain adaptations and modifications of a machine for manufaduring rollers for spinning, for which letters patent were granted to the present patentee, bearing date the 20th September, 1859 (No. 2139); and it consists in applying the method of milling flutes in rollers, for spinning to milling, or roughening the surface of rollers to be used as self-acting temples, and the taking-up rollers in weaving. 5, In a new method of fluting rollers for preparing and spinning. This invention is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Oct. 24, 1862.

2868. J. Wright, 12, Copthall-court, civil engineer. Improvements in the construction of seamless stays. (A communication.)

Dated Nov. 25, 1862.

3162. W. B. Caulfield, 30, Queen-street, City, stationer. A new kind of porous stems for tobacco pipes.

Dated Dec. 30, 1862.

3479. W. Clark, 53, Chancery-lane, engineer. Improvements in governing apparatus. (A communication.)

Dated Jan. 9, 1863.

72. C. Worssam, Commercial Wharf, Kingsland-road, engineer. An improved lithographic press.

Dated Jan. 21, 1863.

177. J. W. Meears, 4, Whistler-court, Cannon-street, gentleman. A new and improved method for making sash frames and sashes, and suspending the same by atmospheric or gas pressure.

Dated Jan. 26, 1863.

227. J. B. Fell, Sparkbridge, near Newton in Cartmel, engineer. Improvements in working railway engines and carriages on steep inclines.

Dated Jan. 28, 1863.

255. S. W. Francis, Gray's Inn-road, shutter maker. Improvements in revolving shutters.

261. B. l'A. Bromwich, Charterhouse-square, gentleman. An improved mode of obtaining and applying motive power.

Dated Jan. 29, 1863.

263. T. A. Weston, Birmingham, mechanical engineer. A new or improved coupling and break for transmitting or regulating or arresting motion.

264. J. B. E. Louit, ainé, Bordeaux, gentleman. Improvements in glasses termed chimneys, used for gas or other lights.

267. J. Pouncy, Dorchester. Improvements in obtaining, transferring, and printing from photographic pictures or images, also in peparing materials for the same.

269. J. Nadal, Brook's-market, Brook-street, Holborn. Improvements in fountains.

271. C. H. G. Williams, Rumford-street, Glasgow. Improvements in the manufacture of red colouring matters.

273. G. Blake, Trowbridge. Improvements in apparatus for heating and warming.

275. J. Sainty, Burnham, agricultural implement manufacturer. Improvements in feeding troughs for sheep and other cattle.

Dated Jan. 30, 1863.

279. W. F. Gedge, 11, Wellington-street, Strand. Improvements in cones, or forms, for moulding refined sugar. (A communication.)

281. N. P. C. Lloyd, 1, Liverpool-street. An improved atmospheric engine, applicable to purposes to which steam, horse, wind, and water power is applied.

Dated Jan. 31, 1863.

287. J. Grossmith, 85, Newgate-street, merchant. An improved mode of producing the aura electric gas.

289. W. Drummond, Bank of England. Improvements in apparatus for stopping the supply of gas to burners when the light is put out.

290. W. A. Lyttle, Andover Lodge, Albion-road, Hammersmith, gentleman. Improvements connected with cigars and other tobacco-smoking appliances.

291. E. B. Wilson, Parliament-street, Westminster, engineer. Improvements in supplying air, gases, steam, or fluids, to iron and other furnaces, and to engines and vessels requiring such supply, and in the apparatus employed therein.

Dated Feb. 2, 1863.

293. E. H. Massey, 15, Pine-grove, Crown-street, Liverpool, painter. Improved preparation or compositions for coating and colouring the walls, ceilings, and other parts of buildings.

295. A. Forbes, Canal-terrace, Aberdeen. Improvements in means or apparatus for soldering together parts of vessels formed of tin or tinned plate.

297. R. H. Frith, Leinster-road, Rathmines, civil engineer. Improvements in manufacture of paper.

299. W. Clark, Quadrant-road, Highbury New-park, engineer. Improvements in armour plated and other ships.

Dated Feb. 3, 1862.

301. T. Raworth, Leicester, elastic web weaver. Improvements in looms for weaving ribbons, elastic webbing, and other narrow fabrics.

303. S. Oddy and E. Oldfield, Adelphi Iron Works, Salford, machine makers. Certain improvements in carding engines.

305. A. T. Blakely, Parliament-street, and J. Vavasseur, Southwark, engineer. Improvements in projectiles for ordnance.

307. W. G. Valentin, Royal College of Chemistry, Government School of Mines, Oxford-street, chemist, and F. Levick, Blaina, Monmouth, iron master. Improvements in generating combustible gases, and in the apparatus employed therefor.

Dated Feb. 4, 1863.

309. G. Harton, North-road, Highgate. Improvements in wood paving.

311. T. E. Tallent, New Church-street, Bermondsey. Improvements in the manufacture of leather, and in machinery for that purpose.

313. G. Haseltine, 12, Southampton-buildings, Chancery-lane. Improvements in the mode of uniting metallic surfaces. (A communication.)

315. J. J. Hays, Hitchin, Hertford, gentleman. An improved hot air stove, where peat charcoal is the fuel employed, and for the method of using peat charcoal, or other suitable fuel, in connection with the said stoves, or other stoves, for the purpose of purifying or filtering the gaseous products of combustion.

316. L. J. H. Marville, 2, Rue Ste. Appoline, Paris, merchant. A new kind of covering for the ears, made of india rubber, gutta percha, or other materials.

317. Z. M. Parkes, 7, Upper Park-place, Plumstead-common, gentleman. Improvements in iron and other metal bond for use in building.

319. B. Russ, Bristol, Gloucester. Improvements in the construction of iron ships and vessels, and of armour applicable thereto.

321. J. A. Manning, Inner Temple, Esquire. Improvements in the treatment of night soil and other waste products, and for the manufacture of manure therefrom.

322. W. Stokes, builder, Edgbaston. Improvements in the construction of window sashes, whereby the same are rendered more weather proof and secure against draughts and burglars, and permit the outside to be cleaned with the facility of the inside.

Dated Feb. 5, 1863.

323. W. T. Mabley, Altrincham, Chester, mechanical engineer, and W. T. Cheetham, Ashton-under-Lyne, mechanical draughtsman. Improvements in blowing organs and other such musical instruments, parts of which improvements are also applicable to obtaining motive power for other purposes.

325. W. Betts, Wharf-road, City-road, capsule manufacturer. Improvements in apparatus for applying metallic capsules to bottles.

327. E. Ingham, Halifax and Bradford, dyer and finisher. An improved apparatus for, and means of, dyeing wool in the silver, from which "mixture yarns" may be drawn.

328. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in machinery for supplying and spreading wool and other filamentous materials on belts, tables, and other surfaces, to be afterwards carded and otherwise acted on. (A communication.)

320. J. Paterson, Staining-lane, warehouseman. Improvements in buckle and hook fastenings.

330. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in apparatuses for tuning pianofortes. (A communication.)

Dated Feb. 6, 1863.

331. B. F. Bates, Morley's-hotel, Strand. Improvements in cannon and in projectiles to be used therewith. (Partly a communication.)

333. T. Blakeley and B. Meakes, Bread-street-hill, Cannon-street. An improved lead and stone pencil sharpener.

335. G. Stevens, Victoria-terrace, Camberwell. Improvements in means or apparatus for effecting a regular supply of air or aeriform fluids for various purposes.

337. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in carding engines, whereby slivers are formed into threads ready for spinning. (A communication.)

339. J. Price, 84, High-street, Southampton, wholesale ship chandler. Improvements in signal lanterns suitable for being used in open boats.

341. A. Ellissen, Warwick-road, Maida-vale, merchant. An improved method of treating sheeting and plates of iron to be used in ship building and marine constructions for protection against marine animals and marine plants.

Dated Feb. 7, 1863.

343. J. Sirou, Castel Sarrazin, Tarn et Garonne, France. contractor of public works. A new medicinal preparation for internal and external application.

345. G. Turner, 13, Rose-terrace, Brompton, machinist. Improvements in means or apparatus for mincing or cutting meat or other substances.

349. J. James, 12 and 13, Red Cross-square, Cripplegate. An improved covering for hooped skirts.

351. M. Hackforth, Bentinck-street, Manchester-square, painter and decorator. Improvements in shades or reflectors for lighting purposes.

353. D. Groucutt, Coseley, iron master. An improvement or improvements in the manufacture of iron for making nails.

Dated Feb. 9, 1863.

357. D. Law, ironfounder and engineer, and J. Downie, engineer, Glasgow. Improvements in traction engines or common road locomotives.

359. H. and J. Smith, Bury St. Edmunds, implement makers. Improvements in drills or machines for depositing seed and manure.

Dated Feb. 10, 1863.

361. J. Crosby, Audenshaw, manufacturer, and J. T. Smith, Bury, engineer. Improvements in carding engines for carding and drawing flax tow, in part applicable to carding cotton or other fibrous substances.

363. R. Burley, Glasgow, hammer handle maker. Improvements in handles for hammers, mallets, picks, mattocks, and similar tools.

365. M. Cartwright, Hoxton, dentist. Improvements in combining plastic substances with metals.

367. W. Whitaker, Bradford, merchant, and W. Tongue, engineer. Improvements in apparatus and processes for steeping, boiling, washing, bleaching, and dyeing, fibrous materials or slivers, slubbings, rovings, yarns, or woven fabrics of the same.

Dated Feb. 11, 1863.

371. J. Duckworth, Pilkington, near Manchester, size manufacturer. Improvements in the manufacture of paper.

375. W. Symington, Glasgow, manufacturer. Improvements in weaving, and in apparatus therefor.

377. E. Humphrys, Deptford. Improvements in apparatus for steering ships.

PATENTS PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF A COMPLETE SPECIFICATION.

Dated Feb. 18, 1863.

414. M. Ohren, Sydenham. Improvements in the construction of gas-holders, and in the mode of rendering gas-holders self-acting.

LIST OF SEALED PATENTS.

Sealed Feb. 20, 1863.

2362. H. P. Hughes.
2364. J. and B. Harrison.
2370. A. Crichton.
2374. R. Sims.
2384. J. J. Potter.
2389. J. J. Moeckel.
2400. G. W. Dyson.
2402. P. W. Mackenzie and S. W. Smith.
2406. E. T. Hughes.
2407. E. C. Harding and C. Doody.
2414. J. Walker.
2428. R. Glanville.
2468. C. W. Williams.
2537. J. Whines.
2580. H. R. Fanshawe.
2910. A. Krupp.

Sealed Feb. 24, 1863.

2379. R. A. Brooman.
2381. J. G. Nutting.
2390. E. Lachenad.
2391. W. Husband.
2401. W. Owen.
2408. F. Le Conte.
2411. J. Meyer.
2416. J. Ellis.
2417. J. Whitehead.
2418. E. G. Fitton.
2419. J. Watt and T. S. Havialde.
2147. J. Platt and W. Richardson.
2449. R. P. Coles.
2471. J. Whitehead.
2522. H. J. Lewis.
2529. E. G. Chant.
2637. J. Brown.
2650. W. and W. Carrick.
2709. C. Chinnock.
2775. J. H. Johnson.
2836. G. T. Bousfield.
2934. A. Guild.
2979. J. H. Johnson.
3002. T. Brown.
3052. A. Graemiger.
3061. E. S. Ritchie.
3100. N. Thompson.
3203. T. Evans.
3209. J. Anderson.
228. W. E. Newton.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, Feb. 24, 1863.

2764. H. Bridstone and J. Alcock. Folding, measuring, and hooking woven fabrics.

2765. E. Barlow, J. Clough, and F. Hamilton. Driving cotton gins.

2766. J. Snider. Hansom cabs.

2769. M. Cartwright. Artificial teeth.

2773. O. J. and J. Showell. Glass roofs and roof lights.

2777. W. Wilson. Drawing-room bagatelle and billiard table.

2778. J. H. Jenkinson. Drinking fountains.

2782. W. Pope. Coating the sides of ships, batteries, forts, or other like places with defensive armour plates.

2790. W. Barningham. Permanent way.

2800. J. Robinson. Protecting the submerged portions of iron ships.

2801. E. Hely, jun. Envelopes.

2803. J. Summerton. Harrows.

2804. H. Wickens. Making nails. (Partly a communication.)

2807. G. T. Bousfield. Manufacture of iron and steel. (A communication.)

2812. J. Bentley. Forming and pressing felt hats.

2813. B. Lauth. Polishing metals.

2814. R. A. Brooman. Doubling and twisting threads. (A communication.)

2819. G. Haseltine. Forging cannon and other heavy articles. (A communication.)

2822. N. R. Hall and M. L. Parnell. Thermometers.

2826. J. H. Johnson. Boiling liquids and cooking or preparing food. (A communication.)

2834. J. T. Cooke. Battens for weaving.

2835. R. A. Brooman. Waterproofing. (A communication.)

2847. E. W. Hughes. Turntables and turnbridges.

2853. A. Chaplin and G. Russell. Obtaining fresh water by evaporation.

2855. W. Clark. Sewing machines. (A communication.)

2863. A. J. F. V. Brepson. Siphoidal cistern.

2877. W. Clark. Construction of the joints of pipes. (A communication.)

2883. J. Chattwood. Ventilating.

2888. W. J. Williams. Field rakes. (Partly a communication.)

2921. J. Unsworth. Steam-engines.

2948. T. Gibson, T. Hall, and T. Davison. Railway breaks.

3010. C. O. Heyl. Extracting oils.

3166. W. Longley. Making bricks.

3175. A. V. Newton. Preparing oxide of zinc. (A communication.)

3204. W. Clark. Cutting cork. (A communication.)

157. E. Sable. Artificial stone. (A communication.)

176. S. Blackwell. Applying water to animals.

225. F. Tolhausen. Carding fibrous materials. (A communication.)

239. J. Edmonson and T. Ingram. Looms and apparatus for weaving.

265. J. Mackenzie. Shaping machines for curvilinear surfaces.

282. W. E. Newton. Couplings for railway carriages. (A communication.)

301. T. Raworth. Weaving ribbons, elastic webbing, and other narrow fabrics.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

435. A. Belpaire.
440. H. D. P. Cunningham.
508. J. H. Johnson.
587. J. Eccles.
475. C. Schiele.
723. J. Aspell.
755. C. Ashworth.
465. Sir C. T. Bright.
527. T. Silver and J. Hamilton.
564. R. H. Collyer.
522. G. Jenkins.
562. W. E. Newton.
605. J. Howard.
624. A. Paget.
664. W. E. Newton.
485. R. A. J. Dujardin.
494. J. Pegg.
499. E. Mucklow.
503. W. H. Muntz.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

452. J. S. C. Heywood and G. Lloyd.
420. W. G. Merrett.
561. E. Schischkar.
431. J. Freer.
470. H. Loveridge.
505. T. T. Jopling.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending February 27, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2015	0 4	2024	1 4	2033	0 10	2042	1 4	2051	1 8	2060	0 10
2016	0 10	2025	0 6	2034	0 8	2043	0 8	2052	0 8	2061	1 0
2017	0 6	2026	0 8	2035	0 4	2044	1 4	2053	0 4	2062	0 8
2018	0 4	2027	1 4	2036	0 4	2045	0 8	2054	0 8	2063	0 4
2019	0 10	2028	1 4	2037	0 8	2046	0 4	2055	0 6	2064	1 0
2020	0 8	2029	0 8	2038	0 4	2047	0 4	2056	1 4	2065	1 0
2021	0 4	2030	0 8	2039	2 2	2048	0 4	2057	0 8	2036	0 10
2022	0 4	2031	0 8	2040	0 8	2049	0 10	2058	0 10	2067	0 4
2023	0 8	2032	0 4	2041	0 4	2050	1 4	2059	0 4		

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Timber, duty 1s. per load, drawback, 1s.

	£	s.	£	s.
Teak ... load	14	0	15	0
Quebec, red pine	3	10	4	10
,, yellow pine	3	0	4	0
St. John, N.B., yellow	5	0	5	10
Quebec oak, white	5	10	6	10
,, birch	3	0	3	10
,, elm	3	10	5	0
Dantzic, oak	3	10	6	10
,, fir	2	10	3	10
Memel, fir	3	0	3	5
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzig, fm.	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	19	10
St. John, white spruce	14	10	16	10
Yellow pine, per reduced C.				
Canada, 1st quality	17	0	18	0
,, 2nd do	11	0	12	0
Archangel, yellow	13	0	13	10
St. Petersburg, yellow	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white	9	0	9	10
Gefle, yellow	10	0	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.				
,, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
Pumice Stone, per ton	5	10	9	0

OILS, &c.

	£	s.	£	s.
Seal, pale ... per tun	47	10	48	0
Sperm body	85	0	86	0
Cod	47	0	48	0
Whale, South Sea, pale	44	0	0	0
Olive, Gallipoli	59	0	60	0
Cocoanut, Cochin	54	0	54	10
Palm, fine	38	0	38	10
Linseed	43	0	0	0
Rapeseed, English pale	53	0	0	0
Cottonseed	34	0	45	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
Iron:									
Welsh Bars, in London	per ton	6	10	0	to	7	0	0	2½
Nail Rods	,,	7	5	0	,,	7	10	0	,,
Hoops	,,	8	10	0	,,	9	0	0	,,
Sheets, single	,,	9	10	0	,,	9	15	0	,,
Staffordshire Bars	,,	7	15	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	17	6	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	14	0	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
Steel:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	10	0	,,	18	0	0	,,
Copper:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8¼	,,	0	0	8¼	,,
Fine Foreign	per ton	95	0	0	,,	98	0	0	3
Tin:									
English Block	pr cwt.	5	19	0	,,	0	0	0	2½
Bar	,,	6	0	0	,,	0	0	0	,,
Refined	,,	6	4	0	,,	0	0	0	,,
Banca	,,	6	2	6	,,	0	0	0	nett
Straits	,,	6	1	0	,,	6	2	0	,,
Tin plates:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	6	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
Lead:									
Pig, English	per ton	21	0	0	,,	21	10	0	2½
Spanish, Soft	,,	20	7	6	,,	20	10	0	,,
Shot, Patent	,,	23	15	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	0	0	0	,,
Spelter:									
On the spot	,,	18	5	0	,,	18	7	6	nett
Zinc:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
Quicksilver	pr btl.	7	0	0	,,	0	0	0	3
Regulus of Antimony:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,

4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, MARCH 6, 1863.

ON WAVE MOTION.

A THIRD volume of "Transactions of the Institution of Naval Architects" has just been issued to the members and associates. It contains reports of the papers read at the last session, with the discussion upon them. It is illustrated by numerous steel engravings and woodcuts, executed in the best manner, and is, as a piece of book making, most creditable to the Institution. Its real value must, however, be tested by quite another standard, and we are very glad to be able to say that it is a most valuable addition to our naval science.

At the preceding session, a paper was read by Mr. Froude, a pupil, we believe, of the late Mr. Brunel, and brother to the well-known historian of that name, upon the rolling of ships. His attention was directed to the subject by Mr. Brunel in connection with the "Great Eastern," and with the object of discovering the probable sea-going qualities of that ship. He soon observed that the most noteworthy phenomenon connected with the motions of a ship under the impulses of the waves, was the gradual accumulation of angle during several successive rolls; the cumulative action growing up into a maximum, and then dying out by very similar gradations. The ship having remained steady for a moment, a nearly similar series of excursions commences and is reproduced.

He observed that the very large angles of rolling which are occasionally reached, are never due to single wave impulses, but are invariably the cumulative results of the operation of successive waves. This view of the facts was supported by the Rev. Canon Moseley, who presided on the occasion when the paper was read. Alluding to the way in which the repetition of the impulses exerted upon the floating body is made to modify the oscillations, he said:—"If, when a vessel first rolls, and then rolls back, at the instant that it has got to the extreme roll back you apply a second impulse, you very considerably increase the amount of the succeeding oscillation; and, if you wait till the third extreme roll and then apply a third impulse, you impel her through a still further angle; and so you may go on, applying such impulses at those particular periods. The effect of such accumulation of motion is displayed in the case of suspension-bridges, some of which have been brought down by the steady marching of a body of troops, owing to the fact of the steps of the troops synchronizing with the oscillations of the bridge."

The question, therefore, which proposed itself to Mr. Froude, was,—"What is the cumulative result of the continuous action of a series of consecutive waves operating on a given ship?" and, as a most important step towards this discovery, "what attitude does the ship, at each instant, seek to occupy in reference to the wave on which she floats, and what measures the force which urges her to take that attitude?" In supplying an answer to the question, Mr. Froude has rendered most important service to this department of scientific research. He tells us that, to a particle of fluid or floating matter at any point in the surface of a wave, or of any non-horizontal volume of free fluid, a tangent to the surface at the point in question is virtually level. If, therefore, the configuration of such a floating particle were such as to give it stability in still water, so that it would always endeavour to place its "axis of equilibrium" in a vertical position, then were this same particle floating on a wave, it would, by virtue of the same property of stability, endeavour to place its "axis of equilibrium," not vertical, but *at right angles to the surface of the wave.*

As an illustration of the way in which a motion of translation modifies the ordinary effects of gravity in such cases, he refers to the fact that, if a spirit level is attached at the centre of oscillation of a pendulum, and is adjusted level when the pendulum is at rest, then upon setting it in motion it will be found that, if the pendulum is allowed to oscillate freely, the spirit will continue to indicate level at all angles of inclination. He made, moreover, the following experiment, to test the accuracy of this principle. A float was formed of cork, somewhat like a small life-buoy, about four inches in diameter; a mast was planted obliquely in one side of it, with its apex perpendicular over the centre of the float; a small plumb-bob was suspended from this, having its centre at the level of the centre of buoyancy of the float, and occupying, when in still water, the centre of the ring. When this was set afloat in a trough fitted with apparatus for generating waves, while the plane of its floatation followed the slope of the waves, the plumb-bob remained nevertheless, so completely central, that to an eye resting on it it was difficult to believe that the surface was really disturbed by waves, though, on watching the sides of the trough, it was plain that the wave slope ranged up to 15 degs. or 20 degs., the plumb-line, at the same time, deviating to the same extent from the perpendicular; and, Mr. Froude says, that in trying the experiment in the sea, he has seen the bob remain equally central, while the float rested in the hollow front of a breaking surf wave, even where the surface was considerably "overhanging," so that the line sloped upward from the point of suspension.

In the present volume there is a paper by Mr. Crossland, of the Department of the Controller of the Navy which, while it establishes on a firm mathematical basis the main positions of Mr. Froude, shows that some of his views require to be modified.

The feeling expressed by Dr. Woolley with regard to Mr. Froude's paper, was shared by other mathematicians. He said that while he considered the memoir to be a most valuable and suggestive contribution to the science of naval architecture, by the perusal of which we could not fail to have our ideas of the subject enlarged, he yet doubted the sufficiency of his theory to account for all the phenomena presented by a ship rolling in the trough of the sea. He doubted whether when a body of any kind floated on a disturbed fluid it would necessarily accept the dynamical conditions of the fluid it displaced, and he did not consider the experiment described above to be at all conclusive. Notwithstanding this, he went on to say, "I think that in the absence of a more precise theory—a theory which I fear there is little prospect of our being able to arrive at—Mr. Froude's speculations possess the greatest interest and value, and approximate in their *results* to the case presented by natural phenomena."

The suspicions which this gentleman had formed were justified by his able pupil, Mr. Crossland, in the paper referred to above, in which he pointed out the limits of his adhesion to the theory of Mr. Froude, and securely established that which he accepted.

Dr. Macquorn Rankine followed on the same subject, suggesting a simpler mode of arriving at the differential equation of the ship's motion, by assuming the trochoid to be the approximate figure of the wave instead of the curve of sines.

He shows also the cause of the difficulty in estimating correctly the height of waves from the deck of a vessel. The passenger, looking at an advancing wave from a vessel which is situated on the sloping side of the contiguous wave, takes as the horizontal a plane which is a tangent to the side of the wave at his position, and which appears to him to be the level. Under such circumstances the apparent height of the wave would sometimes be as much as three times the real height.

The practical conclusions to which we are led by these papers, are as follow:—

That every ship has a certain time of oscillation, depending on her form and on the disposition of her weights and cargo. This time is uniform, and is not affected by the force or rapidity of motion of the waves.

The distance between the crests of the waves is also uniform for certain conditions of wind and sea, and there is therefore, a certain uniform interval between the blows of successive waves upon a ship exposed to them.

If this interval is, under any circumstances, the same as the time taken by the ship in making each roll, then the ship will be capsized.

The object of the naval architect must be to make the time of oscillation of the ship as different as possible from the average periods of the waves.

These periods are usually shorter than the time of the ship, it is therefore desirable to make that time as long as possible—in other words, to make the ship roll slowly.

Happily, the heavy armaments and armour of our modern ships tend to increase this time, and in this respect there is also a decided advantage in having the armour and the guns as far as possible from the middle of the ship.

In addition to these, there are very valuable papers on the Magnetism of Iron, and Compass Deviations, by the Astronomer-Royal, by the Superintendent of the Compass Department at the Admiralty, by Archibald Smith, Esq., M.A., F.R.S., and by the Secretary to the Liverpool Compass Committee.

These are followed by numerous papers on Practical Questions in Shipbuilding and Marine Engineering, some of which we hope to be able to notice.

CALIFORNIA AND GOLD.

(Continued from page 114.)

IN our first notice of M. Laur's interesting account of the Californian gold workings, we traced the gradual progress of these remarkable undertakings, and their development from a mechanical point of view. We will now describe the application of the *sluice* system to the *mountain placers.*

The *placers* of the mountains are sandy deposits mingled with metallic gold, formed by the action of the waters on the primary auriferous rocks, during the first period of the diluvian epoch; and which were spread by the same agencies over the western slopes of the Sierra-Nevada mountains. These strata, disturbed to some extent by the geological revolutions of successive ages, still extend over a large surface of territory. The auriferous layers extend about 150 kilometres (93 miles) from south to north, and 40 kilometres (24 miles) across the three counties of Sierra, Placer, and Nevada. They form high table lands or terraces on the slopes of the Nevada mountains, and these gold strata generally crown the valleys, 150 to 200 metres deep, excavated by the waters in the living rock. The layers of gold gravel extend to a great depth, being seldom less than 12 metres thick (39 ft.) M. Laur states that he has seen them 60 metres (196 ft.) deep in certain places. These deposits contain gold throughout the entire mass; but there is more gold to be found in the large pebbles at the bottom than in the finer sand at the top.

Each layer has thus a richness according to its particular level, but experience has shown that the whole series of layers affords a tolerably equal average of gold throughout the whole expanse of the formations.

This gravelly soil could, probably, cover a surface of 15,000 square kilometres (5,775 miles), with a layer of auriferous sand, at least 10 metres (32 ft. 8 in.) deep. It can be regarded as an auriferous deposit giving a constant average of produce, like coal strata, or beds of ironstone, and can, therefore, be worked on a similar scale to the latter minerals. The *general average* of gold in this formation is very low, if measured by the cubic metre. Mons. Laur states that he is probably above the mark in estimating the general average of gold contained in the alluvium as worth 1f. 50c. per cubic metre. What a wide difference with these times when the sands of some of the Californian rivers gave up 9 per cent. of their weight in gold! Nevertheless, the Californian miner, even out of this poor alluvium (worth, at the most, 1f. per ton), produces, per day's work of one man, 220 grammes (7 oz. troy) of gold, of the value of 750f. We will now see how this is effected.

The gold miners of the Nevada mountains call to their aid the power of great currents of water. These water currents are supplied by the snows covering the Nevada chain of mountains during six months of the year; by the lakes in the neighbourhood, and by the mountain torrents. The miners have built immense water reservoirs, and conduct the water by means of canals, tunnels, and aqueducts, down the steep slopes of the hills. The main stream is fed upon the auriferous strata by means of secondary streams. The length of these canals, for the whole of California, probably exceeds 8,000 kilometres (4,960 miles). The water drops on to the *placer* from a canal placed as high as possible above the cutting that is being worked. The old excavations are thus at the foot of the aqueduct. The auriferous gravel is cut perpendicularly from the top to bottom, from the grass above to the rock below. This perpendicular cutting extends like an immense wall, 40 or 50 metres (130 to 165 ft.) high, and several thousand metres long; at the foot of which are placed, at intervals, the wooden erections for operating upon the mass of alluvium. The excavations are made by means of regular hydraulic batteries. The water of the upper canal is received by a large conduit made of iron plate, and it drops from the whole height of the trench. The water current has thus a fall of 40 or 50 metres (130 to 165 ft.). It descends at last through a final pipe of smaller diameter, and through which opening, guided by the miner, the water plays upon the wall, and detaches great lumps of gravel, thus sapping the wall to its foundation.

Three water jets are used to produce the maximum effect. The gravel seems to melt away under the action of the streams of water. Torrents of mud and large cakes of earth rise up at the foot of the cutting; they are then conducted by extensive trenches into a subterranean gallery, where they are recived by broad deep sluices. The gold gradually separates itself from the torrents of mud, and drops to the bottom, to which it adheres, as it gets amalgamated with the mercury. The barren substances then flow onward, and are disgorged into the hollow of some deep valley, where they remain till displaced by the winter torrents.

Such are the main principles upon which the auriferous deposits of the Nevada *placers* are worked. We will now give some of the results, and will take as an instance the *Eureka* workings, near San Juan. The auriferous deposit measures about 43 metres (145 ft.) thick at this place. The undertaking employs four jets of water, furnishing about 15,000 cubic metres (525,000 cubic feet) of water per ten working hours. The miners break down and wash about 2,808 cubic metres (98,280 cubic feet) of alluvium with this water. The expenses are as follow:—

Water bought of the canal companies, per day . .	540 francs.
Hand-labour and superintendence	86 ,,
Tools	50 ,,
	676 ,,
The gold produces on an average per working-day . .	3,000 ,,
Net profit per day is thus .	2,324 francs.

Four men are sufficient to conduct the entire undertaking. We can perceive, by combining the above figures, that the quantities of gold produced by each cubic metre of earth is worth 1f. 7c.; the gold corresponding to each square metre of surface is worth 45f. 95c. The net profits for each man's daily work are, therefore, 581f.; the rough produce being 220 grammes (7oz. troy) of fine gold. By comparing the primitive plan of gold washing by means of a dish with the present method of the water jet, it will be seen that, to wash a cubic metre of sand, would require three days and three-quarters according to the old plan, while it only requires one-sixth of a minute with the new method.

Each hectare (nearly 2½ acres) of the alluvium thus contains 460,000 francs worth of gold dust. Some time before M. Laur left San Juan, a mine was sold near the Eureka workings. The mine measured twenty acres, and it was divided into twenty-four shares. Each share was sold for about 6,000f. cash. The hectare (2½ acres) thus cost 96,000f.

Such is the progress that has been acheived up to the present. M. Laur considers that important additional improvements can be made. Present results show that it is sufficient to have plenty of water and to be able to drop it down at great heights, in order to produce large quantities of gold. These two conditions of the problem can be resolved on an extensive scale in California. To further demonstrate this, we will take another mountain *placer* as an instance—the placer belonging to the mine of San Juan.

This placer appears like an extensive table land of gravel. It has the shape of a rough triangle, and is bounded on the east by the crests of the Nevada hills, and on the other two sides by two deep cuttings or valleys, fed by tributary streams of the Yuba, South Fork, and Middle Fork rivers. The auriferous gravel crops out along the courses of these valleys, but the alluvium is at a great height (more than 656 ft.) above the river courses. The thickness of the auriferous alluvium, measured on the incline of the table land, and along the valleys, is almost always more than 30 metres (98 ft.). The thickness of the gravel in the centre of the district is unknown. There is reason to believe that in some places there are not less than 100 metres (328 ft.) of gravel mingled with gold. The total area of the *placer*, according to tolerably correct maps, is 650 square kilometres (247 square miles).

If we now allow that this diluvial earth, impregnated with gold, has an average thickness of 30 metres or 98 ft. (the minimum measurement); and if we further suppose that the gravel contains 1 fr. 30 cents of gold per cubic metre (an average deduced from many undertakings), it will be seen that the total value of the gold contained in this single fragment of auriferous soil is not less than 25 millions of francs. This is an enormous and almost incredible sum. We must, however, remember that similar deposits have yielded 2 milliards 900 million francs of gold, within less than 12 years. All this mass of precious metal can be extracted. The means to effect this consist in the water for washing the gravel, and in the tunnels for carrying off the refuse. Such tunnels can be excavated as far as may be required, and with the necessary incline. This can be effected by starting with the adits from the sides of the valleys, and at the same time passing below the auriferous strata. The only thing now wanted would be a plentiful supply of water for washing the gold. As regards the *placer* we are now speaking of, this want has been fully supplied. A company of French miners, known under the name of the Eureka Lake Company, has carried out this extensive undertaking.

The Eureka Company collects the winter rains from the twenty eight lakes or high valleys of the Sierra-Nevada mountains. There are twelve dykes already constructed, thereby forming the same number of reservoirs of water. The canals that convey the waters and distribute them over the gold field are 337 kilometres long (209 miles). These conduits of water cross the mountain gorges by means of numerous aqueducts. A magnificent one, called the Magenta aqueduct, measures 1,900 ft. long, and has a height of 45 metres (147 ft.). The company already supplies 40 millions of cubic metres of water annually; but an exact gauging of the reservoirs shows a total supply of 480 millions of cubic metres. If we suppose a loss of one-third in evaporation, in standing still, &c., there remains a total of 320 millions of cubic metres for gold washing purposes. This quantity is about 100 times the annual consumption of the mine of San Juan alone, that we have already taken for an example. We can now suppose that the entire gold field, if fed by all the water of the Eureka Company, would produce one hundred times as much gold as the single mine of the San Juan. A total of sixty millions of francs' worth of gold per annum would thus be produced. According to the figures that have been given somewhat previously by M. Laur, it will be seen that the production of sixty millions could be continued for five years without exhausting the gold deposit. M. Laur has supposed that the mine of San Juan is only worked two hundred days in the year.

Such is the balance-sheet of one of the Californian mountain workings of auriferous gravel, and such is the future that these deposits open for the production of gold.

The alluvia we have examined are not the only gold mines of California. We have to show the importance of the *primary* auriferous deposits. A short description will suffice. The golden belt of California is traversed through its entire length by an unbroken bundle of large and small veins of quartz. This zone has a maximum breadth of about 12 kilometres (7½ miles); its length is at least 200 kilometres (124 miles). The quartz veins traverse all kinds of soil, and they extend to any depth. They sometimes crop up to the surface, and show their course for several leagues. The veins are formed of a hard and white rock, called rock crystal. They all contain gold. Sometimes the gold penetrates the entire depth of the seam, and in the form of a fine dust like flour; in other instances the gold is found in enormous nuggets of dazzling wealth. The quantity of gold contained in each cubic metre of rock is generally higher in the smaller than in the larger veins, and there is, generally, more gold at the surface. The degree of wealth is very changeable and uncertain; there is nothing to indicate to the miner the amount of the future produce of his labour. Some mines, still at work, give results varying from a maximum of 350f. to a minimum of 35f. worth of gold per ton. It is impossible to carry on an undertaking furnishing less than 38f. per ton of quartz. At Mariposa, in the Fremont Lode, a single blasting operation gave a block of quartz containing 375,000f. worth of gold. Such examples occur but seldom. It is difficult to give an average between results varying to such an extent. M. Laur thinks that he is not far from the truth in estimating the average at 16 or 18 dols. (about 18f.) per ton. There is thus nearly one hundred times as much gold in a ton of this mineral compared with the gravel of San Juan; but what a difference in the labour necessary to extract the metal!

In working the gold quartz it is necessary to blast the rock by means of gunpowder, and the mines are often filled with water. In order to pump out the water, and to wind up the minerals, steam-engines are required. On the gold quartz being brought to the light of day, the gold must be separated from the barren rock. In California, these expenses come to 33f. 70c. per ton, by the time the mineral is excavated. The ore has then to be conveyed from the mines to the stamping mills, and the carriage increases the expense by about 3f. 50c. per ton. At the works the gold quartz must be broken up and crushed to fine sand, by means of heavy cast-iron stampers, driven by a steam-engine, or a water wheel. The sand must then undergo the washing and amalgamating processes to extract the gold. The expenses of these further operations come up to about 17f. 80c. per ton, of mineral. A sum of 3f. per ton must be added to these special expenses; on account of the general outlay required in all undertakings of some importance. The total expenses thus came up to a sum of 60f. for the manipulation of one ton of quartz. M. Laur has given above 85f. per ton, as the average produce of this class of gold ore. The profits is thus only 25f. per ton; a very low sum for enterprizes of this description.

The gold quartz mines of California are not very attractive at present, but magnificent hopes were conceived of them at the beginning. This was in 1853; the river *placers* were then nearly exhausted. The crests of some quartz veins at Grass Valley, at Nevada, and at Mariposa, furnished very rich ores, and thus immediately attracted the attention of the miners. These men repeated that the gold was not to be found in extraneous situations, but rather in the depths of the ground; the real source of the treasures was in the bowels of the mountains. The rocks were at once attacked on all sides. Within less than three years a number of steam-engines from London and New York, amounting to 1,500-horse power, were set to crush the quartz of the Nevada mountains. The results were very disappointing; and a great number of the original companies got crushed under the heavy expenses. The entire plant of the ruined undertakings was then purchased under cost price by fresh companies, who were thus enabled to work with some profit. These undertakings are still carried on, but, in general, they work with some difficulty. They have to encounter two continually increasing obstacles—1, a diminution of the produce; and, 2, an increase of the expenses, as the excavations get deeper. It is possible that this state of things may improve, as the price of hand-labour will probably get lowered. The production could thus be kept up; but these quartz mines do not offer those immense prospective results afforded by the great extent of the *diluvial alluvia*. The working of the quartz mines struggles between the poorness of the quartz and the expenses of its manipulation. The outlay increases with the depth of the mine, while the amount of gold contained in the quartz proportionately diminishes. The production of the gold, day by day, narrowed between these two limits, will always be of comparatively secondary importance.

This information as to the goldquartz mines of California possesses a peculiar interest at the present time, as several companies are being formed in London to work the gold quartz found in Wales. The relative positions of England and California are evidently very different. The prices of labour, transport, steam power, and capital, are necessarily much lower with us than in California. As is well known, traces of old Roman gold workings have been discovered in Caermarthenshire, resembling the similar Roman remains often found in Transylvania. M. Laur, as we have seen, lays great stress on the fact that the gold quartz always diminishes in wealth in a direct ratio to the depth from the surface. It is probable that the same phenomenon will be observed in the Welsh quartz rocks. It is a matter of history, recorded in "Cæsar's Commentaries," that the Romans invaded Britain for the sake of her mineral wealth. Even now, the Cornish miners sometimes find small particles of gold in the tin workings. The Black Prince was aided in his French wars by a gold mine at Combmartin, in Devonshire. The gold of Wicklow, in Ireland, is another instance of the precious metal being found in the British Isles. Just as the Californian rivers became impregnated with gold through the undisturbed and prolonged action of water currents on the gold-bearing rocks, so, in the same way, it is possible that the British rivers contained at one time some amount of gold dust. It will probably take thousands of years before Californian rivers return to their pristine state in 1848. We can thus fully understand that the ancient British rivers may have contained a certain amount of gold, of which but few traces are now to be found.

There are several other kinds of gold-bearing rocks in California, besides the auriferous quartz rock. M. Laur observed several mountains of shist impregnated with gold through their entire mass. These deposits are almost unknown, and have not been excavated. It is impossible to precisely determine their importance.

An important conclusion can at once be drawn from the facts as stated above. California will never cease to produce large quantities of gold. The amount extracted at present, 230 to 250 millions of francs, will probably increase; and in no case will the production diminish before centuries have elapsed. The influence in the money market of such a quantity of gold, extracted at a price so much below market value, offers a problem well worthy the attention of the political economist. This is more especially the case if we take into account the profitable influence of the new methods of working on the production of the gold existing in other parts of the world besides California. It is at present pretty certain that *diluvial auriferous* alluvia exist throughout the entire chain of the Ural mountains, from Ekaterinenburg to the Frozen Sea, and through the whole of the great hilly chain separating Southern Siberia from the Chinese Empire; from the high table-lands of the Kirghez up to the sources of the River Amur. Gold is scattered throughout the entire surface of this territory; a length of more than 4,500 kilometres (2,790 miles.) This immense gold field has been worked at a great number of places, and gold has everywhere been found. The eminent geologist, Sir R. Murchison, has established, in his reports, that the auriferous alluvia of these regions afford an average of five millionths of their weight in gold, or about 5 grammes (77 grains) of metal per ton of sand. Further, that the working expenses are so high, that no profit is afforded if this proportion gets lower than two millionths, or two grammes of gold (30·8 grains) per 1,000 kilogrammes (19½ cwt.) of sand. These figures prove that 400 grammes (12·8 oz. troy) of gold are expended in extracting one kilogramme (2·2 lbs. avoirdupois.)

Let us now suppose that, other things being equal, the new methods invented at the *placers* of the Sierra-Nevada could be applied on the Altai valleys. The alluvia producing only two grammes (30·8 grains) per ton, at present abandoned as too poor, could be immediately worked at a great profit; for the Californian method in its highest development can elaborate, without loss, minerals containing only five grammes (77 grains) of gold to 100 tons of sand. Those gold soils, the contents of which are between these two terms: two grammes (30·8 grains) of gold to 1,000 kilogrammes (19½ cwt.), and five grammes (77 grains) of gold to 100,000 kilogrammes (nearly 100 tons), at present abandoned, could be at once worked with profit. There is not the slightest doubt that this gold bearing mineral exists in very large quantities, and that the amount of gold to be extracted is very great. The present workings produce five grammes of gold per 1,000 kilogrammes of washed-out sand; but instead of expending in this work two grammes of the precious metal, the Californian methods would only expend five centigrammes (0·77 grains.) The kilogramme (2·2 lbs. avoirdupois) of gold, instead of costing 400 grammes (12·84 oz. troy), would only cost ten grammes (154·34 grains), an expenditure forty times less.

We might multiply these instances, and we could compare the gold washing of the Rhine, of the Brazils, of Chili, and of Peru, with the working by the *sluice*, and the Californian method of excavating the soil by means of water jets. We should then see that the employment of these new processes would doubly increase the production, first, by increasing the area of the gold fields workable with profit; and secondly, by diminishing the working expenses. It can thus be asserted that in future gold will be produced cheaper and in greater abundance than formerly, in all the gold mines in the world. No term can be assigned to the amount of this production, on account of the infinite variety of the gold deposits, nor would it be possible to state the lowest converging point of the price and value of the *still* precious metal.

Such has been the part played by California in the production of gold. It has not merely produced the metal in large quantities, but this country has also revealed to the whole world the best methods for cultivating gold. Through an accidental discovery, California suddenly burst upon the scene, and almost immediately produced nearly as much gold as all the rest of the world put together. (Before 1848, all the gold mines of Europe, Africa, and America together, produced 247 millions of francs of gold per annum. The production of California alone came up to 228 millions in the year 1851.)

California has shown that gold, like commoner metals, is to be found extended over large surfaces, within the rocks, or spread over their exterior, and that gold has been brought to the light of day by similar geographical revolutions to those that have produced the mines of lead and copper; worked for so many centuries in the old world. The facts observed on the Sierra-Nevada, of California, led one to believe that gold is perhaps more abundant on the surface of the earth than had been previously supposed. It is well known that an attentive examination of the California hills led the miner Hargreaves to conclude that gold was also to be found in the mountains of New South Wales; at present the California of England.

It can be said that California has vulgarized gold, and it is probable that this country has thereby given an impetus to the great manufacturing activity in Western Europe that has marked the last two years. Will California ever effect the same for silver as for gold? M. Laur is inclined to believe that this will be the case. Not that the country contains the silver itself, as was once erroneously supposed, but because California can supply, in great abundance, another metal, very expensive up to the present. This is mercury, an indispensable agent in all the silver mines of the new world. In the mountains on the coast, near San Francisco, there exist extensive veins of sulphuret of mercury. These veins have been worked for a few years only, and they produce already more than 1,340,000 kilogrammes (nearly 132,000 tons) of quicksilver. This is as much as the produce of all the other mines of the world put together. Mercury was formerly sold in San Francisco at 7f. to 8f. the kilogramme; it will soon be only worth 3f. or 4f. There is no doubt that this great lowering in the price of mercury will, ultimately, also cause a great reduction in the price of silver.

What will be the ultimate results of this immense influx of the precious metals on the money market? These are great and important inquiries. The continued and rapid increase in the production of gold will of itself answer these questions within no lengthened period of time.

H.

GUN SHIELD AND GREAT GUN EXPERIMENTS AT SHOEBURYNESS.

(From our Special Reporter.)

Tuesday last was the first day of the experimental season at Shoeburyness. There was a numerous gathering of members of the Ordnance Select Committee and Iron Plate Committee, and military and naval officers. Only a limited number of civilians were present; but Royalty was not wanting, Prince Louis of Hesse and Prince Arthur being on the ground. The proceedings, which commenced at 10.30, were not terminated till four o'clock.

The experiments on this occasion had a double interest, their object being to test the resisting force of a gun shield, constructed under the direction of Captain Inglis, of the Royal Engineers, and the destructive powers of the guns of three eminent artillerists—Armstrong, Whitworth, and Lynall Thomas. The nature and object of the gun shield not being generally understood, some description of it may be acceptable to our readers.

As we pointed out in a recent article, the introduction of iron-clads into naval warfare, makes it compulsory to protect land batteries for coast and harbour defences with iron casing. An armour-plated vessel carrying a few heavy guns could range alongside a battery unprotected with iron, and damage it seriously without receiving any material injury itself. In the attack of the "Montauk," turret gunboat, armed with only two Dahlgreen guns, on a fort commanding the entrance to the port of Savannah, the vessel fired 84 rounds at point-blank range, and was struck by 46 heavy shot, receiving little injury, but also doing no material damage to the land batteries, because, as it is stated, they were iron-plated. Our Government has been fully sensible to the necessity of this kind of protection for our maritime forts, and intends to apply it without delay to those on the most vulnerable points of our coast. They are only waiting for the Ordnance officials to determine which is the best system of armour-plating for the purpose, and, in that respect, there is as much perplexity in the professional and scientific mind as there is with reference to iron-clads. In this matter the Ordnance is acting with laudable caution, being apparently anxious not to fall into the error committed by the Admiralty, of adopting and expending large sums on a system which has not been tested. The War Department has been for some time engaged in the construction of experimental gun shields, some of which were tried last year, with doubtful results. The one tested on Tuesday was regarded by the officials as a combination of the best points of those previously tried. Its chief feature is massive strength, resulting from great thickness of solid metal, obtained by iron planks placed across each other. These planks are 5, 6, 7, and 8 in. in thickness, and are about 20 in. in width, those in the front being 8 ft. long in a vertical direction, and those behind 11 ft. long in a horizontal direction, corresponding to the dimensions of the shield, which are 11 ft. in width and 8 ft. in height, with an embrasure in the middle, 3 ft. 6 in. by 2 ft. 4 in. Strong iron struts, projecting behind at each end, and connected with vertical and horizontal iron bars with a section of 9 by 5 in., together with foundation plates, form a framing, which supports the structure, the whole being fastened together by 3-inch through bolts, which pass through holes perforated in the planks and supporting bars. The heads of the bolts being conical, hold the plates in front, and are screwed up behind with nuts against iron washers, some of which are combined with india-rubber, some with plaited wire, and others with lead. Some washers are all iron, and a few of the bolts are rivetted. These different kinds of washers and bolts represent two systems of resistance, the elastic and the rigid, the efficacy of which was put to the proof by the powerful projectiles fired at the shield. The entire structure was, indeed, severely tested; but before we describe its condition at the close of the experiments, we will give an account of the performance of the guns.

Four guns were made use of—the Whitworth 7½-inch hexagonal bore, the Armstrong 9-inch smooth bore, the Armstrong 10½-inch rifled on his shunt principle, and Lynall Thomas's rib-rifled 7-inch bore. We purposely name the guns by their bore, because it is the true measure of their force, as it regulates the charge; and we wish to put an end to the objectionable practice of expressing the force of a gun by the weight of the projectile, which, in the case of elongated shot, conveys an erroneous conception of the real character of the arm. This has given rise to much confusion, and has even been the means of misrepresentation in puffing the Armstrongs into notice. The old-fashioned smooth-bore nomenclature is right. The weight of a spherical shot is regulated by its diameter, which corresponds with the bore of the gun. But an 8-inch rifled breech-loader, which is only a 70-pounder, does not become a 110-pounder or a 200-pounder by being loaded with a bolt of the latter weights; nor is a 10½-inch shunt muzzle loader, which would only carry a 150 lb. round shot converted into a 300-pounder, by increasing the length of the projectile. Whitworth's gun, which should rank as a 70-pounder, is improperly called a 120-pounder. When a 68-pounder is double shotted, it does not become a 136-pounder. If this deceptive mode of measuring the force of guns by the weight of metal discharged from the muzzle, is to be followed in experimental practice, we shall, when a comparative trial of smashing effect is to come off, put in a claim on behalf of the old naval 68-pounder, that it be fired double-shotted, with an increased charge proportioned to the additional quantity of gunpowder used in an Armstrong or a Whitworth when a demonstration is to be made. The fact is, that a great delusion has been practised on the minds of the uninitiated by parading high figures as the weights of rifled bolts. Increase of weight sacrifices velocity; and as projectile force is a compound of weight multiplied by the square of velocity, the explosive force remaining the same, the useful effect, the real work, of the 200-pounder Armstrong shot is less than that of the 100-pounder, and the effect of the 300-pounder less than that of the 150-pounder. The experiments at Shoeburyness have proved that fact; it is well known to Sir William; and nevertheless, to this day his 100 and 150-pounder guns are boastingly designated as 200 and 300-pounders. There was a time when he thought he should establish a reputation for his artillery, by firing elongated projectiles of great weight, but the Warrior-target demolished that thing. The 200 lb. shot fired from the 100-pounder were a complete failure. They had no penetrating force—they produced a slight indentation, and fell exhausted at the foot of the target, unbroken, except at the nozzle of the cone, not having force enough to destroy themselves, although made of cast iron.

Although the experiments extended over so long a time, seven shots only were fired at the Inglis target. The intervals between them were necessarily long, to give time to the officials to examine and take notes of the results. As the Ordnance and the Iron Plate Committee were mutually interested in the attack and defence, a double set of officers were engaged in observing the results of every shot, and during the early part of the morning there was much delay arising from vessels passing within the range. We understood last year that this obstruction to the practice at Shoeburyness was removed by an Act giving the War Department jurisdiction over the navigation along this coast, a certain distance out to sea. The Act being passed, the proper authorities should take care when experiments are to be made to adopt and give publicity to a signal to warn off the barges and small coasters which use this passage.

The first shot was fired from the Whitworth hexagonal bored gun—the same gun which drove flat-headed steel shot and shell through the "Warrior's" armour plates. The projectile was of the same description as the solid bolts fired on that occasion, weighed 148 lb., was made of homogeneous iron, and fired with 25 lb. of gunpowder, the impact velocity being 1240. To render our description of the effect intelligible, we will here explain that the outer face of the shield being covered with the vertical iron planks in six divisions, each 8 ft. high, and about 20 in. wide, we will refer to them as Nos. 1 to 6, reckoning from the left front, No. 3 containing the embrasure in the middle. This first shot struck No. 5, the second plate to the right of the embrasure, extending a little over the joint to No. 4. The effect was tremendous, and is best described as an awful smash. The shape of the area of impact was curious; it had no approach to the circular form, but was irregular and apparently splashed, as if a mass of clay had been dashed against the plates. The surface thus covered measured about 16 inches in every direction; its size and irregularity prove that the projectile, from the nature of the material, did all its work on the plates. It did not, like cast-iron shot, break up at the moment of impact into fragments, which recoil, but the whole momentum of the entire mass fell on the plates. The actual indentation it was impossible to measure: a large piece of the projectile was imbedded in No. 5 plate. The damaging effects behind the shield told the force of the shock; the massive frame-bar at the bottom, with 12 in. of solid iron intervening between it and the impact, was dislodged, and parts of the supporting strut were separated from each other. One bolt, which afterwards broke, was supposed to have been cracked by this shot. In front a crack ran across the impact surface; and the plate to the left (No. 4), which is 8 inches thick, and was only grazed by the shot, was broken in two about three feet above the line of the blow.

The second experiment was with Armstrong's 9-inch smooth-bore, from which a spherical shot weighing 100 lb. was fired with a charge of 25 lb. and a velocity of 1,470 ft. per second at the moment of striking. This was the highest velocity attained in this day's practice, and confirms the superiority of smooth-bores, already established by the 68-pounder, over rifled guns at short range, proving that at close quarters the former are more formidable than the latter. The most experienced naval officers are of opinion that the attention of artillerists should be directed to the improvement of the smooth-bore as a more effective means of producing a perfect naval gun than any system of rifling. Has Sir William Armstrong become a convert to this opinion? Are we to take the introduction of this 100-pounder as an indication that he is not so wedded to the rifled principle as he was? If so, Mr. Whitworth must look to his laurels; for if any dependence is to be placed on the theory of momentum in projectiles, the new Armstrong is a formidable competitor. It has, with 25 lb. of powder, its service charge being 35 lb., produced a result equal to the maximum effect of the hexagon 148-pounder. The former, with its service charge, would, probably, without any risk, produce a velocity exceeding 1,600 ft., whilst the charge of the latter could not be safely augmented. But things should be called by their right names. The Armstrong is a 9-inch, the Whitworth a 7-inch bore; the first carries a heavier charge, and ought to be of greater force. The second shot did extensive damage to the shield. If the effect of impact on the surface was not so great as that of the first shot, the difference is to be ascribed to the inferiority of the metal of which the former was composed. By breaking into fragments it did not do all its work; whilst the success of Mr. Whitworth on this as on former occasions, is largely due to the very superior quality of the iron of which his projectiles are made. The damage, however, to the target was extensive. The 8-inch plate No. 4, was cracked across at the line of impact. The 5-inch plate at the back was broken in two; a frame bar, 9 by 5 in., supporting these two plates behind, was bent in about 2 in.; a 3-inch bolt was broken off at the nut, and the joints of the frame opened ¼ to ½ an inch at several places. The third shot, weighing 230 lb., was fired with a charge of 45lb. from Armstrong's 10½-inch rifled shunt. This gun is called anything. from a 150 to a 300-pounder. The plate struck, No. 6, was 6 inches thick, the third to the right of the embrasure. The damage done, although the projectile and the charge were so heavy, was by no means equal to that resulting from the two first shots. Still it shook the frame bars and strut terribly, separating the parts 1 to 2 in. and driving the foot of the latter out of its place. The maximum effect of this gun would, no doubt, be obtained with a hollow shot weighing 150 to 170 lb. and a charge of 50 lb.; but the question is, will the peculiar rifling bear so heavy a charge?

The Lynall Thomas rib-rifled 7-in. gun discharged the fourth shot, which was of wrought iron and weighed 150 lb., with a charge of 25 lb. and a velocity of 1,150. Plate No. 1, the outer one on the left, was struck about the middle vertically and close to the joint of plate No. 2, to the right. The indentation was round, about 7 in. in diameter and 2 inches in depth. The effect on the plates was more damaging than that of any preceding shot, two plates being cracked across their entire width toward the top, in a continuous zig-zag, from the embrasure to the outside of the shield through a bolt-hole a few inches above the impact, and one plate broken in two at the bottom. The strut and frame at the back were considerably shaken, and a bolt destroyed.

No. 5 shot was a repetition of No. 1—namely, a Whitworth 150-pounder, from the same gun, with a charge of 25 lb. Although it touched the ground and ricochetted a few yards in front of the target, it gave proof that its destructive force was little impaired. It struck a small plate, 24 in. by 21 in. and 8 in. thick, under the embrasure, this plate being backed with a 5 in. plate, which was supported behind by a bar 5 in.; thick by 9 in. wide. The plates which had been in close contact were separated ¾ to 1 in. and the bar was bent outwards 2½ in.; two bolts were broken, one being torn out of an adjoining plate, apparently by the sudden jerk of the bent bar, and hurled ten or twelve feet behind into a bank of earth. The lead washers to some of the bolts, ¼ to ½ an inch in thickness, were by the immense force squeezed to the substance of a thin card.

No. 6 was a second trial of the powers of the 10½-in. Armstrong, loaded this time with a 300 lb. cast-iron shot and 45 lb. of powder. This projectile hit the joints of plates 4 and 5 a little to the right of the embrasure, a few inches above the wide-spread indent of the first Whitworth, and partly on plate No. 4, of which the lower part had been cracked by the Armstrong shot, No. 2; this plate, although 8 in. thick, was split in two at the upper part. The whole structure of the shield was shaken by this heavy blow so near the top.

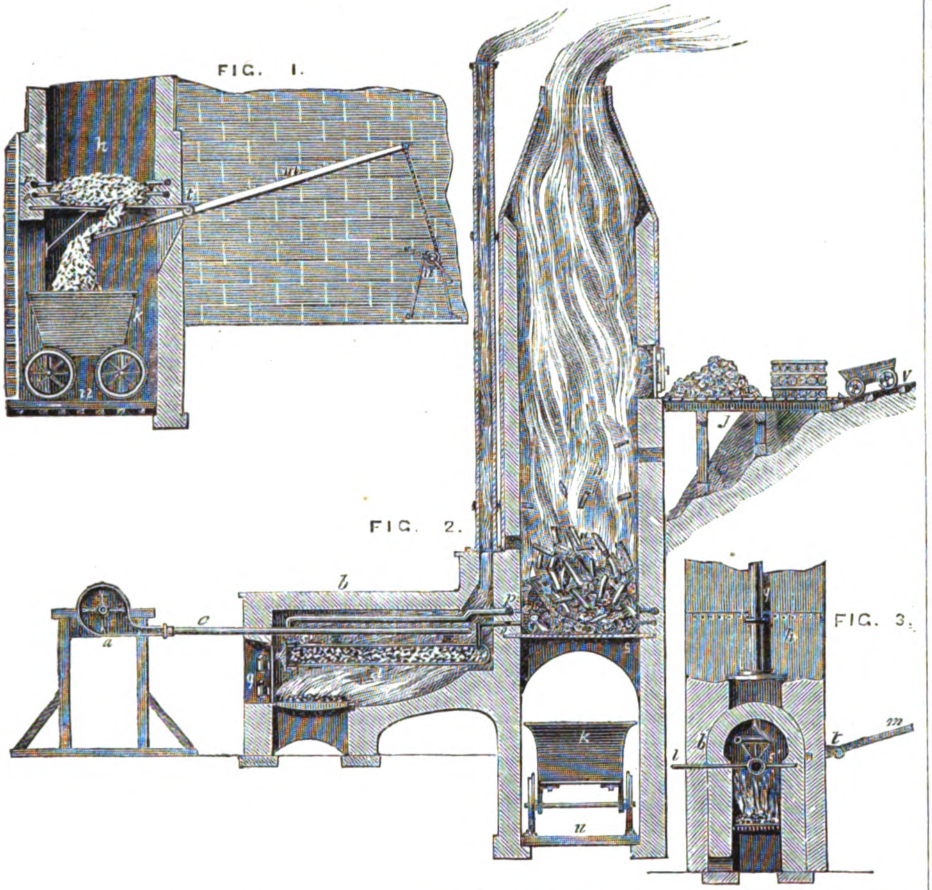
The last gun fired was the Lynall Thomas, which ended the experiments and its own existence by bursting with a tremendous crash. The shot missed the target and sped its way seawards. This was a sensation event. Many lookers on, who from the splinter proofs kept their eye on the gun, saw a black mass spring into the air through the canopy of smoke. The numerous groups which, after every shot had run a race at double quick to examine the target in a somewhat amusing fashion, rushed simultaneously at full speed to the battery, where a scene of havoc was exhibited. The massive tube, with the breech-end blown away, and the shrunk ring to which the trunnions were forged, burst asunder, lay prostrate on the ground, the carriage having been blown into fragments which lay scattered over the field. The mass of iron which had been seen high in air was found at a distance of 150 yards. The fracture of the breech showed the following dimensions—bore, 7 in.; inner steel tube, 1½ inch, and iron breech, 8 in. in thickness; making a total diameter of 26 in., without the outer shrunk ring or hoop, which was 13 in. wide by 3 in. thick. In an article on ordnance a few weeks ago, we pointed out that the peculiar kind of rifling of this gun made it probable that the action of the grooved projectile on the side of the rib, cut in relief on the bore, would show the strain of the force so much on the rib that there would be danger of bursting.

Mr. Lynall Thomas attributes the accident to the fact of the steel tube which carries the rifling being too much cut away. On the ground, it was stated that this work was done at Elswick. A larger gun on the same principle is being manufactured at Woolwich under the careful superintendence of Mr. Anderson. Mr. Thomas is confident of its success, but we fear the mode of rifling is a source of weakness which no care can overcome.

BLISS'S IMPROVED FURNACE.

THE annexed engravings represent an arrangement of apparatus for heating ores and generating steam, recently patented by Mr. W. Bliss, of Chipping Norton, which he describes as follows:—The blast furnace is closed at its lower end by a valve or slide, so that after the process of heating or calcining the quartz or ores the contents of the furnace may be discharged through an opening in the bottom of the furnace, which is closed by a valve or slide during the heating or calcining process. At the lower part of the blast furnace there is a hollow space all round, into which air, and also the gases obtained from decomposed steam, are forced during the process of heating or calcining the quartz or ores. A steam boiler is employed in connection with the blast furnace, by the fire used for heating which a retort is also heated, and it is found convenient to arrange this retort so that it may form the bridge across the end of the boiler furnace; but the retort may be otherwise arranged and heated. By means of a fan or other suitable blowing apparatus air is forced into the hollow space at the lower part of the furnace, and passes through several openings from such chamber into the lower part of the blast furnace, and it is preferred that the air thus forced into the blast furnace should be heated in its passage from the blowing apparatus to the furnace by causing it to pass through a pipe or pipes, or passages, heated by the fire of the boiler furnace, but the heating of the air may be otherwise accomplished. In the retort charcoal is placed, and steam from the boiler is caused to pass through and amongst such charcoal and from the retort. The gases, and any steam which may not be decomposed, pass into the space at the lower part of the blast furnace, and thence through the passages into the blast furnace. In working with this arrangement of apparatus a quantity of fuel is placed at the bottom of the blast furnace, and also the quartz or other ores requiring a like process. Air and gases are forced into the blast furnace, by which a very high degree of heat is obtained; after a time it is preferred to stop the introduction of the air blast, and to continue the application of the gases till the process is com-

BLISS'S IMPROVED FURNACE.



plete. The air and gas pipes are protected by fire-clay or bricks when using the apparatus for generating steam to be applied to work steam-engines, and where no heating or calcining furnace is used, the gases obtained from the steam are used in the steam-boiler furnace.

SOCIETY OF ENGINEERS.

March 2nd, 1863.

ON THE RELATION BETWEEN THE SAFE LOAD AND THE STRENGTH OF IRON.

By Zerah Colburn, Esq., C.E.

A great number of experiments have been made by many experimenters, to ascertain the ultimate resistance of iron to tension and compression, and its strength has thus been determined with perhaps as much precision as is possible in the case of a material presenting almost constant variations of quality. Every engineer is now aware that, as an average result, the tensile strength of cast iron may be taken as about 8 tons per square inch, and its crushing strength at 48 tons. Wrought iron of fair quality will bear from 26 tons per square inch in tension, while its crushing strength is variously stated at from 12 or 15 tons per square inch up to 28½ tons, the last named being given by Mr. Mallet as the result of experiments upon large hammered bars, which bore but from 23 tons to 24 tons in tension.

When, however, we come to the question of safe-working strength, much difference of opinion exists among engineers, the permanent supporting power of iron being variously estimated at 4-10ths down to 1-10th of its breaking strength. Thus when, some fifteen years ago, a Royal commission sat to inquire into the application of iron to railway structures, the late Mr Glynn, in his evidence, recommended that a cast-iron bridge should never be loaded beyond one-tenth of its ultimate strength. The late Mr. Stephenson, with several other engineers, thought a ratio of one-sixth sufficient, while the late Mr. Brunel was satisfied with a ratio of from two-fifths to one-third; or, in other words, if a girder would just bear 100 tons of distributed load, he would put from 33 tons to 40 tons upon it, where Mr. Stephenson would allow not more than 17 tons, and Mr. Glynn only 10 tons.

Were we now to have another commission entrusted with the same inquiry, it is not unlikely that as great a difference of opinion would be found still existing. For there is no acknowledged natural principle upon which the safe load of iron has yet been determined, and in the absence or oversight of such a principle each engineer must be governed by his own judgment of what is safe and prudent. It is true that the authority of the Board of Trade has been so far exercised in this matter as to have limited engineers, in the design of wrought-iron railway bridges, to maximum tensile strains of 5 tons per square inch; and although it is commonly believed that with wrought iron a compressive strain of from 4 tons to 4½ tons corresponds to a tensile strain of 5 tons, the Board of Trade impose the same limit of strain for both the top and bottom chords of a wrought-iron girder. The limit of 5 tons per square inch, it is hardly necessary to say, is an entirely arbitrary one, nor is it modified according to the quality of the iron and workmanship in a structure. Thus, in girder bridges, plate iron is used, of which the breaking strength is occasionally not more than 18 tons per square inch. In punching the rivet holes, however, and irrespective of the loss of the metal actually punched out, the solid iron remaining between the holes is injured, so much so that, in a series of experiments made many years ago by Mr. Fairbairn, the mean tensile strength of seven specimens was reduced from 52,486 lb. per square inch before punching to 41,590 lb. per square inch of solid iron left between the holes after punching—more than 20 per cent. of the strength of the iron being destroyed by punching, a loss distinct from that of the metal actually punched out. Drilled rivet holes, it is satisfactory to know, are now being adopted in the best class of bridge work; but in bridges already erected and containing plates occasionally no stronger than 18 tons per square inch before punching, the loss of strength ascertained by Mr. Fairbairn would diminish this to about 14⅓ tons for the net section of metal between the rivet holes. On the other hand, the best suspension-bridge links have a strength of from 26 tons to 28 tons per square inch of section, and yet the Board of Trade inspecting officers would not probably depart from the arbitary limit of a maximum strain of 5 tons in either case. As far, therefore, as is necessary to meet the requirements of the authorities, good iron and sound workmanship go for little or nothing: and not only does this remark apply to the inference of the Board of Trade, but in the case of Chelsea Suspension-bridge, the chains of which are believed to have a tensile strength of upwards of 25 tons per square inch, two of the leading members of our profession have declared that structure to be unsafe until it shall have been so strengthened that the greatest load which the heaviest traffic is likely to bring upon it shall not exceed 5 tons per square inch of the sectional area of the chains. The highest authorities, we are justified in supposing, would, at the same time, be satisfied with the same maximum strain in the chords of a plate girder bridge, even if the actual breaking strength of the solid iron between the rivet holes did not, as we have reason to believe it often does not, exceed 15 tons, or three-fifths that of the links of Chelsea Bridge.

While some of the conditions of elastic action are now under consideration, it appears desirable to define, as nearly as may be, what elasticity really is. We are all familiar enough with its manifestations, as in a watch spring, an air cushion, or a bit of india-rubber, but we seldom inquire to what condition of matter these manifestations are to be attributed. When, however, we regard matter of any kind as a collection of distinct molecules or atoms, between which the force of attraction is always predominant in solids, and the force of repulsion in gases, we have no difficulty in perceiving that any alteration in the amount of either of these forces, acting within a body, must produce a corresponding change in the distance between its atoms, and in this very change of distance we have the whole phenomenon of elasticity. Elasticity is not a force, but the result of the antagonism of two opposite forces: an antagonism in which either force continues to act through a certain range or distance—a range differing greatly in different materials—before being completely overcome by the opposite force. Under the influence only of attraction the particles of all matter would cohere, and without repulsion there could be only solid bodies in nature, for the existence of liquids and gases would then be impossible. The repulsive force appears to be the force of heat, to which physical repulsion may be generally traced. Under the influence of heat alone, and without attraction, there could be neither cohesion nor liquidity, and all substances could exist only in the gaseous state. We shall soon be able to trace the bearing which these distinctions have upon the elasticity of iron. At present we have only to bear in mind that there is reasonable physical evidence to show that the atoms of matter, so far as we can comprehend their existence, are never in actual contact with each other, even in solid bodies. Iron, as we know, is a comparatively porous material, since air and water may be readily forced through it under moderate pressures. Mercury, it is well known, will rapidly insinuate itself between the pores of an apparently solid body, for gold immersed in mercury will acquire the condition of an amalgam, and will crumble to powder. We know, furthermore, that the particles of most, if not all, solid bodies may be so far separated by heat as to convert them into liquids, and it is quite reasonable to suppose that, with an additional degree of heat, or repulsive force, all these liquified solids might, like mercury, and even melted gold, be converted into vapours. Now, any force applied after the manner of tension in a bar of iron, thus tending to separate the particles, in opposition to their cohesion or force of mutual attraction, may be considered to act in the same manner as the repulsive force of heat. The point at which rupture will take place will evidently be where the particles are so far separated that the cohesive force is less than the tensile strain, but there is good ground for supposing that, even after rupture, the atoms of the iron would again cohere could they be again brought to within their original distance from each other. This, of course, would be impossible if we attempted merely to place the two fractured surfaces in contact. In the case, however, of two clean surfaces of lead, we may readily bring them so closely together as to restore cohesion, and, in the same way iron journals running in steel bearings occasionally become welded to them when the pressure is too great for ordinary work. In thus bringing two bodies within the range of cohesive force, we must remember that it is the ultimate atoms which cohere, and that the finest perceptible particle of matter may really consist of myriads of almost infinitely smaller atoms. In all welding we first employ a degree of heat sufficient to overcome so much of the cohesive force between the atoms of the iron as to allow of sufficient motion among themselves to bring all, or most of the atoms forming one surface, within cohesive range of those forming the opposite surface. Two cast-iron surfaces are readily welded together by running melted iron between them. Without heat the two surfaces, however well-finished, would touch only at a great number of separate points, although there would be considerable cohesion even then, as every one knows who has brought two carefully scraped surfaces of iron, or two sheets of plate-glass together; and although a part of the apparent cohesion is due to the pressure of the atmosphere, there would really be some cohesion in a vacuum. It is only from the fact that the atoms of matter will always cohere when once brought sufficiently near together, that we are enabled to make bricks and all articles of earthenware. Soluble bodies, like clay or salt, cohere after solution and evaporation, simply because their atoms, having been first separated by the liquid solvent, are again left within cohesive range on the evaporation of that solvent. Bricks, but for the waste of fuel in burning them, might be made from the most dilute solution of clay, and the final baking is only necessary in order to so completely expel the moisture as to bring the clay atoms within the range of cohesion, but their own character is in no respect altered. Iron, were it possible to dissolve it without combining it with nitrogen, oxygen, sulphur, or other matters, would again return to its ordinary granular state, and would recover its cohesion, on the evaporation of the solvent. Great pressure, too, will effect cohesion in the case of substances naturally having none at all. Thus, in experiments made with the ballistic pendulum to ascertain the velocity of cannon shot, the sand packing against which the shot is fired is often converted into sandstone of considerable strength.

From the illustrations given, the elasticity of solids appears to be no more than the range or play of the attractive and repulsive forces of matter, as variably exerted, but within the limits of rupture or crushing. Thus elasticity is the same in kind whether the repulsive or separating force be externally applied, or whether it be that of heat acting between the molecules of the body. If a bar of good wrought iron be stretched to the 1-1000th part of its length, corresponding, say, to a strain of 10 tons per square inch, its elasticity will be fully excited or nearly so, and it will not support a much greater strain without taking a permanent set. It is true that, if the same bar of iron, when not under strain, be heated to from 150 to 200 deg. above its normal temperature, it will also elongate by 1-1000th part of its length, and that without injury. But if this elongation takes place under a compressive strain, or, if the iron, first raised in temperature by 200 deg. and thereby elongated, be attached to two fixed points, and thus, while cooling, be made to contract under strain, it will be found that an elongation of not far from 1-1000th of the original length of the bar is the most that can be borne without injury, even when that elongation is due to heat alone. But if the iron be first heated sufficiently to soften it, as railway tyres and gun hoops are heated, the particles will be re-arranged and, within certain limits without injury; but after the metal has once cooled below the temperature at which the particles have the mobility necessary for this rearrangement, any further contraction around an unyielding object will be attended with permanent and, there is reason to believe, injurious strain. Even in setting railway tyres, it is believed to be best to put them on cold, and under graduated pressure; and in the case of gun hoops, Captain Blakely and Mr. Mallet, who appear to be entitled to the credit of the modern system of the ringed construction of artillery, have always insisted upon the importance of a definite degree of shrinkage of each ring, so that the consequent strain shall not exceed the elastic limit of the material. Sir William Armstrong has stated that he does not consider any especial accuracy essential in the distribution of the strains imparted by shrinking his gun hoops upon each other; but it may be questioned how far the failures of so many of the Armstrong guns have been due to neglect in this respect.

It would be interesting to know the precise manner in which a separating strain acts upon the molecules of iron, or rather to know the successive positions of the atoms during the application of the strain. We are, however, without any positive knowledge of the positions which the atoms assume in solidification and under subsequent forging; but the multifarious forms in which all atoms visibly crystallize serve to show us that they cannot all be at equal distances from each other throughout the whole body. If they were, the arrangement would be that of cannon balls in a triangular pyramidal pile. Could we visibly represent the atoms as occupying the angles of an infinite number of equilaterial triangles, we should understand that a linear strain acting to separate any two of the atoms would, at the same time, draw a third atom, if not a number of atoms partly between them. And when, from this intrusion, the repulsive force, or heat, always enveloping the intruding atom, had once overpowered the attractive or cohesive force existing between the two atoms thus strained apart, these would, in turn, cohere anew to the atom which had been drawn in between them, and thus we should have a permanent rearrangement of the atoms, or, in other words, a permanent set, with permanent elongation in one direction, and permanent contraction in a plane at right angles thereto. That the atoms are thus drawn into parallel rows of straight lines, in many kinds of iron at least, seems evident from the appearance of fracture, which presents stringy collections of particles forming what is commonly called fibre, although there is great reason for doubting that anything like fibre existed in the iron before it was broken. Mr. Kirkaldy's recent extensive experiments appear to show, as many others have shown, that iron may be made to break short or to break with an appearance of fibre, just according as it is broken with a sudden blow or a gradual pull. Something like fibre may be imparted, on a coarse scale, by repeated rolling or in wire-drawing; but it is more probable that masses of atoms are thus drawn into strings than that any fibre is really imparted to the atomic arrangement itself.

It is commonly held that, within certain limits of strain, iron is perfectly elastic. No matter how often it may be stretched or deflected, up to a certain point, the general belief is that it will come back to its original form every time the load is taken off. There are high authorities, however, who maintain that iron takes a permanent set under even very moderate strains. If we are to understand that the set is exceedingly small, this may be true. The late Mr. Hodgkinson, for example, remarked, on the 381st page of his "Experimental Researches," that two cast-iron beams took each a permanent set with weights respectively equal to 1-57th and 1-80th of the breaking weight. In a discussion at the Institution of Civil Engineers, a Mr. Dines mentioned that he had tested upwards of 8,000 cast-iron girders for the late Thomas Cubitt, and that he found it hardly possible to apply a weight so small as not to produce some permanent set, 1-20th of the breaking weight producing a perceptible set. In the experiments of the Iron Commission at Portsmouth a bar of annealed wrought iron 50 ft. long was said to have taken a perceptible set with a weight of less than 1¼ tons per square inch. After this weight had been doubled, however, the set was still only perceptible; and notwithstanding that the elasticity of annealed iron is known to be inferior to that of unannealed bars, the whole set of the 50ft. bar was but the 1-250th part of one inch, after a strain of 8⅓ tons per square inch had been borne; and the set was but the 1-20th of an inch in 50ft. after a strain of 11·9 tons per square inch. Mr. Edwin Clark has experimented on a wrought-iron bar 10ft. long and 1in. square. Under a strain of 3 tons per square inch he gives a permanent set of nearly the 1-4000th part of an inch in 10ft. With 8 tons the permanent set is given as about the 1-1280th of an inch in 10ft., and it was not until a strain of 13 tons per square inch had been applied that a set of 1-32nd of an inch in 10ft. became apparent. With such exceedingly minute measurements, we may, perhaps, doubt if there was really any permanent set at all, with strains under 9 or 10 tons per square inch. An increase of temperature in the bar of perhaps a single degree, while the measurements were being made, would more than account for some of the reported sets, even under considerable strains. Thus Mr. Edwin Clark gives the permanent set of his bar, after a strain of 8 tons per square inch, as the 1-153,846th part of its length, and this is almost exactly what the extension of the bar would have been had its temperature been raised but a single degree between the observations. Iron is heated in the very act of straining it, and a sudden breaking strain will generally leave the broken ends too hot to be handled. Such a slight apparent extension might also have occurred while the shackles by which the bar was strained were coming to their bearings. But even if such a microscopic permanent set really existed, it is one of which no engineer would take the slighest serious notice as affecting the strength of the bar in which it was observed. With the means of measurement commonly employed by engineers ordinary wrought iron is seldom permanently stretched until after it has borne strains of upwards of 8 tons per square inch. In seven experiments by Professor Barlow, on wrought-iron bars 10 ft. long, two of them retained their full elasticity under a strain of 11 tons per square inch, three bars bore 10 tons without injury, while one bore 9½ tons, and another, made from old furnace bars, did not retain its elasticity beyond a strain of 8¼ tons per square inch. All the links for the Pesth Suspension-bridge, upwards of 5,000 in number, and 12 ft. long from centre to centre, were tested without permanent set up to 9 tons per square inch, and those of Chelsea Suspension-bridge were tested without permanent elongation up to 13½ tons per square inch. Mr. Edwin Clark, from the results of his experiments, considers that the limit of elasticity of wrought iron is 12 tons per square inch, and this appears to have been adopted by him both for bars having a breaking weight of 24 tons and for plates having a breaking weight of 20 tons. Every chain cable purchased by the Admiralty is tested up to 11·46 tons per square inch of the metal in each side of the link, the standard test being 630 lb. for each circular ⅛ in. of the diameter of the iron of which the cable is made, one half of this strain coming upon each side of the link. The iron of which the cables are made does not, as a rule, take any permanent set when strained to this amount, or to say 11½ tons per square inch. Mr. Howard has stated that the best iron begins to stretch permanently under about 10 tons per square inch in 10 ft. lengths, although he occasionally tests up to 15 tons or 16 tons per square inch; the breaking weight being from 26 tons to 28 tons. Mr. Mallet, about four years ago, presented to the Institution of Civil Engineers the results of a valuable series of experiments on wrought iron and puddled steel, from which it appeared that the elastic limit and the breaking strain under tension were, in the case of certain samples, as follow:—

	Elastic limit. Tons.	Breaking weight. Tons.
Hammered slab or bar, 12in. by 4in.	15·312	24·062
Hammered bar	14·219	22·969
Rolled slab or bar, 12in. by 4in.	10·937	22·969
Rolled bar	10·937	22·969
Fagotted forged slab, 4ft. by 4ft. by 1ft	8·750	18·594
Original faggot bars, Horsfall gun	12·031	21·875
Longitudinal cut, forged mass	9·844	19·688
" " "	10·937	17·900
Circumferential "	6·552	16·406
" " "	5·470	16·716
Transverse " "	3·281	6·562
Charcoal rolled bar from borings from the Horsfall gun	5·470	22·321

Sir Marc Isambard Brunel made a number of experiments on Yorkshire iron, hammered to small dimensions, or from ⅜ in. to ½ in. square. A very high elastic limit was obtained, as follows:—

Mean of ten bars, began to stretch with 22·2 tons per square inch, the mean breaking weight being 30·4 tons per square inch. With ten other bars the mean strain at which they began to stretch was 24·4 tons, the breaking strength being 32·3 tons per square inch. It is to be borne in mind, however, that these bars were reduced by the hammer only at the centre of their length and that, therefore, the stretching could be observed upon but a very small part of their length. Mr. John A. Roebling, the engineer of the Niagara Suspension-bridge, has made experiments upon bars similarly drawn down to ¾ in. square at the centre, the breaking weight being 33 tons per square inch; these bars bore a strain of 20½ tons per square inch without visibly stretching, and when no jar was given to the bars they would support this strain for a week. Upon any vibration, however, the bars immediately took a permanent set.

Under strains, however, considerably within the elastic limit, a gradual rearrangement of the particles of the iron commences; and if the strain be continued sufficiently long, permanent set will after a while take place. The late Monsieur Vicat, whose work on limes and mortar is so well known, began as early as 1830 to investigate the effect of continued strains on unannealed iron wire. He applied various strains to similar wires of a known breaking strength, and continued these strains from July, 1830, to October, 1833. One wire was strained to one-fourth its breaking weight, but beyond the elongation which at once took place no additional stretching occurred in thirty-three months. A second wire was strained to one-third of its breaking weight, and in thirty-three months it stretched at the rate of 2¾ parts in every 1,000 parts of its length, this stretching being additional to that which took place as soon as the weight was applied, but which, of itself, was not sufficient to immediately produce any permanent set. Under a strain of one half of the breaking weight, another wire stretched rather more than 4 parts in every 1,000 parts of its length. Under a strain of three-fourths of the breaking weight, a fourth wire stretched, in thirty-three months, 6½ parts in every 1,000 parts of its length, and then broke, which circumstance terminated the experiments. Monsieur Vicat's account of them appeared in the fifth volume of the second series of the "Annales de Chimie et Physique." It is to be regretted that, in place of the constantly recurring experiments upon the breaking strength of iron, and which, as is already beginning to be understood, give us but a very partial knowledge of its available working properties, we have not a larger experimental acquaintance with the continued supporting power of iron, as afforded by experiments similar to M. Vicat's. Mr. Fairbairn, it is true, made an extensive series of experiments between the years 1837 and 1842, to ascertain how long bars of cast iron would support weights equal to about 19-20ths of their breaking weight. By taking care to prevent any vibration in or about the bars, several of them continued, for five years and upwards, to support nearly their full breaking weight. Their deflection steadily increased, however, during the whole time, and Mr. Fairbairn has stated that some of these bars afterwards broke with but 1-20th of their original breaking weight. As bearing upon the last-mentioned circumstance, it may be remarked that M. Vicat, writing in in 1833, observed that Monsieur Henri, an engineer serving in Russia, had already shown that iron which had once withstood a great proof strain often broke some time afterwards under a much less strain. This fact must indeed have been known to practical men even earlier than in 1830.

Now, in employing iron in any structure where it is subjected to strain, we seek to keep within its limit of elasticity. Yet not only have we but a comparatively small number of recorded experiments to show us what this limit is, even under a single and temporary strain, but we have, at least, the result of M. Vicat's experiments to show us that we cannot depend upon anything like this limit under a long-continued strain. What experimental knowledge we have goes to show that the original elastic limit of iron is greater when hammered than when rolled, but we are unable to count with any degree of certainty upon the ultimate superiority of hammered iron, in this respect, after long-continued strain. As a rule, also,—the abundant evidence of which it is not, perhaps, necessary to introduce into the present paper—all harsh, hard, crystalline irons have a higher elastic limit, in proportion to their breaking strength, than soft, ductile, highly fibrous irons—like Swedish bar, for example;—that is to say, the harder irons will bear a greater strain before taking a permanent set, although, as we shall presently have occasion to inquire, it may not follow that they are really superior to other irons which are more readily stretched, and which, indeed, may have an even less breaking weight. What information we have goes to show that there is no settled relation between the elastic limit and the breaking weight of iron; the former is much more variable than the latter, and can hardly be expressed at all as an average result, ranging, as it does, from less than one-fourth to more than two-thirds of the breaking weight: or if the elastic limit be taken irrespective of the breaking weight, the instances already cited show that the former varies from 3¼ tons up to 24½ tons per square inch in different qualities of iron, although the range in ordinary bar iron and plate iron is not nearly as great. Now, no engineer, in apportioning the strains in a structure, would think of working up to, or near to, the breaking strength of iron. His object is to keep within the elastic power of the material, not merely as ascertained by a single strain of a few minutes' duration, but the continued elastic power of the iron as exerted through a very long series of years. We ought by this time to have hundreds of trustworthy experiments upon this point where there is now one. If the safe working strength of a metal is limited, as it would appear to be, by its measure of permanent perfect elasticity, we may say that we hardly know, even yet, what is the strength of the materials we are constantly dealing with, notwithstanding that not a year passes without some addition to our stock of knowledge of breaking weights.

While we are about considering the permanent injury which iron suffers when strained beyond its elastic limit, it is to be understood that iron may be strained for a short time almost up to the breaking point without in the least diminishing its strength under a breaking weight subsequently applied. Indeed, in gradually applying the breaking strain to any sample of iron, it is clear that it must have borne 10 tons before it is subjected to a strain of 15 tons, and that it must have borne 15 tons before it is strained to 20 tons, and so on. Not only is this the case, but after a bar of iron has been actually broken under a tensile strain, the two broken portions of the bar will almost always require a still higher strain to break them. The weakest spot in the bar will fail first, and although the breaking strain will at the same time permanently stretch the bar throughout its whole length, the iron on each side of the fracture will still have its original breaking strength. Professor Barlow's Treatise on the Strength of Materials contains the results of several experiments made at Woolwich Dockyard, as follow:—

A bolt of Solly's patent iron was nicked at one place, and then broken by a strain of 26·7 tons per square inch. One of the pieces was then tried and broke at 29¼ tons. In the next experiment a bar of the same iron was first broken with 23½ tons per square inch, then again with 26¼ tons, a third time with 26½ tons, and a fourth time with 25¾ tons.

Mr. Thomas Lloyd, engineer to the Admiralty, made a like series of experiments a few years ago, on ten bars of SC crown iron, 1⅝ in. in diameter, and 4½ ft. long. The mean breaking weight at the first breakage was 23·94 tons per square inch. At the second breakage, with pieces 3 ft. long, the mean strength was 25·86 tons per square inch. At the third breakage, with pieces 2 ft. long, 27·06 tons per square inch; and at the fourth breakage, with 15-inch lengths, 29·2 tons per square inch. Mr. Lloyd's experiments have been held to show that iron was actually strengthened by stretching it, or, in other words, that by destroying the cohesion at one point, the cohesion was everywhere else increased. A more obvious explanation is, that the bars first broke at the weakest part, then again at the next weakest part, and so on. A variation of from 23·94 tons to 29·2 tons in the strength of the same bar is undoubtedly large, the greater strength being 22 per cent. more than the lesser, a difference which appeared to exist in each of the ten bars tried. It is well known, however, that hardly any two bars of iron have exactly the same strength, and Mr. William Roberts, manager of Messrs. Brown, Lenox, and Co.'s extensive chain cable works at Millwall, has cut a 12 ft. bar of iron into 2 ft. lengths, and found, on testing, that there was a difference of strength of 20 per cent. between the strongest and the weakest of these pieces. In the experiments of the Railway Iron Commission upon the extension of cast iron, the strength of Lowmoor cast bars was 7·325 tons per square inch at the first, and 8·152 tons at the second breaking. Blaenavon iron broke with 6·551 tons per square inch at the first, and 6·738 tons at the second breakage. Gartsherrie iron broke with 7·567 tons per square inch at the first, and 8·475 tons at the second breakage. Other cast-iron bars of a certain mixture broke with 6·6125 tons per square inch at the first, and 6·777 tons at the second breakage, the latter being at an unsound place. Upon these results the commissioners remarked that "it would appear that iron, repeatedly broken, becomes more tenacious than it was originally. This erroneous conclusion may be obviated by considering that it would be very difficult, if not impracticable, to obtain cast-iron bars perfectly sound and 50 ft. long. Fracture may be supposed to take place the first time at the largest defect, and subsequently at those smaller, until, finally, none remain." It is not intended, however, in the present paper, to entirely deny that the breaking strength of iron may be actually increased by being stretched when cold; and this point may be left as an open question. That iron is so strengthened derives some probability from the known fact that its strength is greatly increased by being drawn cold into wire, and also by cold rolling. When heated moderately, or to less than a dull red, and then stretched, iron is strengthened throughout. This treatment is known as thermo-tension; and in an extensive course of experiments made about twenty years ago by Professor Walter R. Johnson, for the United States Government, a total gain of nearly 30 per cent. in strength and length, taken together, was estimated to have been obtained with a variety of irons. A bar of iron, having a strength of 60 tons, was heated to upwards of 500 deg., and then stretched by 6¼ per cent. of its length, when it acquired a strength of 72 tons. Captain Blakely has lately proposed the same treatment of iron, and his experiments, it is understood, corroborate those of Professor Johnson. All the links made for the four great pitch chains employed, with the steamship Great-Britain's engines, for getting up the speed of the screw, were stretched ¾in. while at a dull red heat.

But from what has been said, it is not to be supposed that iron is not injured by excessive strains, notwithstanding that the metal strained may, when tried immediately afterwards, still retain its full breaking strength. The injury will appear when a subsequent working strain is long continued; and even without waiting for this, it will be found that the strained iron has been deprived of a large part, if not the whole, of its natural elasticity. In a paper of great value, read nearly seven years ago before the Royal Irish Academy, and afterwards published in a quarto volume, entitled, "On the Physical Conditions involved in the Construction of Artillery," Mr. Robert Mallet has laid down a useful measure of the working and ultimate strength of iron. Poncelot had already employed coefficients which indirectly expressed, not merely the elastic limit and breaking strength of iron, but the range also through which the force acted in each case in reaching these limits. Mr. Mallet has adapted these coefficients to the English standard of mechanical work, to wit: "foot-pounds;" and he represents the structural value of different materials, or of various qualities of the same material—in one case by the product of the elastic load in pounds into half the range, in feet or parts of a foot, through which it acts; and in the other case by the breaking weight in pounds multiplied also by half the range, in feet or parts of a foot, through which its acts. Mr. Mallet employs Poncelet's coefficients, as follow:—

T_e = foot-pounds in reaching elastic limit of tension.
T_r = ,, ,, to produce rupture by tension.
T'_e = ,, ,, in reaching elastic limit in compression.
T'_r = ,, ,, to produce crushing.

One half the weight into the whole extension, or, what is the same thing, the whole weight into half the extension, is adopted because the force gradually applied to break a bar must increase from nothing to the breaking weight. Upon Dr. Hooke's law, *ut tensio sic vis*, the weight of a grain will in some minute degree deflect or extend the heaviest bar of iron, and the deflection or extension will increase progressively with the weight applied, up to rupture. Therefore, if a bar be stretched 1 ft. and then broken with a weight of 33,000 lb., the work done will be the mean of zero, and 33,000 lb. into 1 ft., or 16,500 foot-pounds. This, as has been said, is the work done in the case of a gradually applied strain. If, however, the weight be applied without impact, but at the same time instantaneously, upon the bar, it will, so long as the limit of elasticity is not exceeded, and supposing the bar to have no inertia, produce twice its former deflection, and, therefore, twice the ultimate strain. For the weight, in falling through the distance of the deflection due to the load at rest, will acquire momentum sufficient to carry it through an additional distance equal to that of the static deflection. This may be best demonstrated experimentally with the aid of a spring balance. If, upon the plan of a balance sufficiently strong to weigh up to 40 lb., a weight of 15 lb. be placed, and this be then lifted to zero on the scale and there released, it will descend, momentarily, to nearly 30 lb. on the scale, and if there were no opposing resistances and the spring had no inertia, it would descend to exactly 30 lb. In the actual application of strains in practice a weight is never thus applied, but a consideration of what would occur under such circumstances is sufficient to show how important it is that vibratory action be not overlooked in considering the strains on bridges. It is to be remembered that this action of suddenly applied loads is only manifested in the case of the application of weights; for if the strain be produced by the sudden admission of steam or any other practically imponderable body, no additional deflection will take place beyond that due to the pressure acting statically. If steam pressure acted in the same manner in this respect as a weight, the steam indicator would show nearly or quite double the pressure acting effectively within the cylinder of the engine.

It will not be attempted in the present paper to enter fully into the application of the coefficients adopted by Mr. Mallett, for there are objections against, as well as reasons in favour of, their application. It is evident that T_r may be the same in two cases—in one of which a high breaking weight is exerted through a very short distance, and in the other of which a low breaking weight produces stretching through a correspondingly greater distance. But this coefficient does possess a value in taking account of the combined cohesive force and extensibility of iron, instead of the breaking strength alone. As Mr. Mallet justly observes, glass has a high cohesive force, and is, nevertheless, useless under strain, owing to its brittleness, while caoutchouc has great extensibility or toughness with but slight cohesion. The products, therefore, expressed by the coefficients in question do not afford a complete notion of the practical value of a given material unless the factors whereby these products are obtained are also given. The elastic limit of iron, however low, is not to be exceeded in practical use, whatever its range of elasticity may be; nor does it appear prudent to work into the neighbourhood of a high elastic limit when the elastic range is known to be small. It is not to be understood that the coefficients in question are intended to apply otherwise than in comparison of bars of equal length, else it would result that the measure of T'_e in a bar 50 ft. long, was one hundred times greater than that of a bolt 6 in. long, and of the same material and sectional area. For the purposes of the engineer a long bolt is not only no stronger than a short one; but, as it can be no stronger than its weakest part, it will follow that the average strength of 100 bolts 6 in. long, is likely to be greater than that of a single bolt of the same diameter and 50 ft. long. Every engineer must be aware of the importance of toughness in combination with cohesive strength in iron, but we need much more extensive and accurate information as to the former; and a consideration of Mr. Mallet's coefficients should lead to additional experiments being undertaken. It is but right to mention here that, in 1848, Mr. Homersham Cox contributed a paper to the *Civil Engineers' and Architects' Journal*, in which he represented the mechanical work, in foot-pounds, expended in deflecting a girder, the work being expressed by the product of half the weight into the range of deflection. Mr. Kirkaldy, proceeding upon an independent course of inquiry, but with the same object as that pursued by Mr. Mallet, has lately published the results of a most important series of experiments, which are the first upon anything like an extensive scale, to take into account the combined cohesive force and extensibility of iron and steel. Mr. Kirkaldy experimented upon many hundreds of specimens, but he did not ascertain their limit of elasticity. He has given both the original dimensions and cross sectional area, and the dimensions and area after fracture; and he has also given the amount of elongation at fracture, although he did not ascertain the extension of the elastic limit. The reduction of diameter of a bar at the point of fracture serves to give a practical man a good idea of the quality of the iron, but it does not admit of an expression of the mechanical work done in producing fracture, as does the combined breaking weight and linear extension. In tearing a bar in two, also, we have to consider the permanent stretch communicated to all parts of the bar alike, and the additional stretch at and near the point of fracture. That part of the stretching which extends uniformly throughout the whole bar would, we may suppose, be exactly proportional to the length of the bar; while that part of the stretch which takes place close to the point of fracture would, we may also suppose, be a fixed quantity, whatever might be the length of the bar. Mr. Kirkaldy's specimens of iron and steel varied from 2·4 in. to 8·2 in. only in length, and with these the ultimate elongation at fracture varied from nearly nothing to 27 per cent. of the original length, whereas longer bars would have shown a proportionally less elongation. The samples which hardly elongated at all were of puddled steel ship plates. One sample, which bore 63,098 lb. per square inch of the original area, stretched before breaking but the 1-20th part of an inch in a length of 7·6 in., or less than 7-10ths of 1 per cent. of the length. Adopting Mr. Mallet's coefficient, the structural value of such a material would be almost nothing. In fact, Mr. Kirkaldy found the puddled steel plates, throughout, to have much less extensibility than cast-steel plates, while the former, also, were of very irregular breaking strength. The interest attached to the subject of puddled steel may possibly serve as a justification for mentioning this fact, although foreign to the object of the present paper, which has to deal with iron.

We have, up to this point, considered the elastic limit or permanent supporting power of iron under a single application of strain, extending in some cases over a few minutes, and in others over some months. We have very little experimental knowledge as to the extent to which we may approach the elastic limit under continued strains; but there is a probability that a continuous strain much exceeding one half of the elastic limit would be attended with gradually progressive permanant set. At the same time, with good iron, possessing a fair amount of extensibility, a single temporary strain, producing a slight or even considerable permanent set, may not diminish materially the strength expressed by Mr. Mallet's ce-efficient T_r, and the iron may still hold up indefinitely with an ordinary load considerably within the limit of elasticity. But, apart from the consideration of the time through which a strain acts, we have also that of the frequency with which the load is applied and removed. Mr. Fairbairn loaded cast-iron bars to upwards of nine-tenths of their breaking weight, and this load remained on for from five to seven years before the bars broke down; but with a repeated application and removal of load, the Iron Commission experiments showed that iron bars, when repeatedly deflected by impact through one half the distance due to their breaking weight, broke down after from 130 to 4,000 applications of the strain. Mr. Fairbairn communicated some of the results of an important series of experiments to the British Association at the Manchester meeting, 1861, from which it appeared that a large model of a wrought-iron plate girder withstood, without injury, 1,000,000 applications of a load equal to one-fourth its breaking weight, and afterwards 5,175 applications of one-half its breaking weight, when it broke down. The model was then repaired, and 25,900 applications of two-fifths its breaking weight, and afterwards nearly 3,000,000 applications of one-third its breaking weight, were made, it was said, without injury, although neither the deflections nor the permanent set were given. We know that iron alters its form, temporarily, during the application of very moderate strains, the elasticity of good iron being generally observable with strains of one ton per square inch. And we know that its form is permanently changed, both immediately on exceeding the limit of elasticity, and gradually under strains nearly approaching that limit. There clearly must be a rearrangement of the particles of iron always going on where the strain is great; and as we know that when even a more moderate strain is eased off the iron tends to resume its original form, it appears incontestible that final injury must result under what may appear moderate, although irregular loads—say one-third, or even rather less of the breaking weight. Iron, it is still to be remembered, has not been employed long enough for purposes of construction to enable us to compare its endurance with masonry, of which there are abundant examples still perfect after many hundred years. At the same time, it must not be forgotten, that, while we can never know the absolute strength of a bar of iron without destroying it under strain, neither can we always infer its strength from its deflection, or apparent range of elasticity; for we are not yet secure against flaws or those other faults of molecular structure which Mr. Mallet so well describes as "planes of weakness." A bar of iron may have a general strength of 22 tons per square inch, except at a single point in its length, where, for an almost inappreciable linear distance, the strength may not exceed 10 tons. If the bar be broken this fault will be detected, but hardly, if at all, otherwise; for under a strain of even 8 tons or 9 tons, the extension at the precise point of weakness would be so slight as to be quite overlooked in a general observation of the total deflection or extension.

In this fact, which was mentioned thirty years ago by M. Vicat, and in the known effects of suddenly applied strains, vibration, impact, &c., we have abundant reason for extreme caution in the use of iron for permanent structures of any kind. It can hardly be said that the Board of Trade limit of 5 tons, arbitrary as it is, is too moderate, although there should be some account taken of the known quality of the iron to which this strain is to be applied; and it may not be necessary to adopt an unlikely load as that which is to produce the maximum strain of 5 tons. The recent discussion as to the security of Chelsea Bridge affords much suggestive material upon these points.

The application of iron to bridges, especially to those of large span, necessarily requires the most careful consideration in apportioning the strains, since every pound of metal not brought into effective action, is so much dead weight or useless load—being not only misapplied of itself, but requiring additional material to support it. In considering the strains upon iron, therefore, reference has been more particularly made in the present paper to its employment in bridges; but in the case of boilers, iron ships, cranes, ordnance, railway bars, warehouse girders and columns, roofs, engine beams, and in many other applications, the most careful distribution of material and adjustment of strains is of very great importance. Iron is, perhaps, more severely strained in steam boilers than in other structures. In the case of locomotive engines, there is a disposition to employ still larger boilers and to carry still greater pressures. With 50 in. boilers, formed of 7-16 in. plates, double rivetted, and carrying, as is now not usual, from 130 lb. to 140 lb. pressure, there is at the higher limit a circumferential strain of 5¼ tons per square inch at the joints, and a longitudinal strain of nearly two tons per square inch along the whole length of the boiler, the resulting strain at the joints being nearly six tons per square inch. This strain is constantly maintained with plates ranging from 21 tons to 24 tons in strength, and under all the contingencies of corrosion, incessant vibration, and occasional sudden exaltations of pressure due to the instantaneous production of steam upon overheated tubes or plates. In many cases we have 4 ft. boilers with ⅜ in. plates, single rivetted, and worked at 120 lb., corresponding to a strain of at least 6¼ tons per square inch at the joints of the boiler when new, the circumferential and longitudinal strains being both taken here into account. Put under this strain when new, many locomotive boilers are worked in all from ten to twenty years, and often from three to seven years, without any internal examination of the plates. It is not remarkable, therefore, that explosions are becoming so frequent.

We may regard with much hope the increasing use of steel in large masses, as prduced by Krupp and by Mr. Bessemer, and others whose discoveries have already effected a great economy in the production of that material. Although a departure from the subject of the present paper, it is interesting also to refer to the introduction of phosphorised copper, as now produced by the Birmingham and other coppermasters. It was announced, about three years ago, as a new discovery by Mr. Abel, chemist to the War Department, that the addition of from 2 to 4 per cent. of phosphorus to copper greatly increased its density and strength. There is no doubt of the large advantage of this combination, although it was discovered in the last century and made publicly known sixty years ago. A French chemist, M. Sage, contributed a paper upon this subject to the *Journal de Physique*, and which was translated into the 20th volume of the *Philosophical Magazine*, for 1805. By combining the maximum quantity of phosphorus with copper, the latter acquired the hardness, grain, and colour of steel; and although M. Sage had already kept the compound for fifteen years, it had suffered no change from exposure to the air. It was easily turned and took a fine polish. It may yet be found that copper thus treated is the best material for many of the purposes of the mechanical engineer.

In conclusion, it must be regretted, if not indeed, deplored that our exact knowledge of the permanent supporting power of iron is so limited. The present paper, it is feared, will hardly fulfil its title, which may have led to the expectation that some definite relation would be assigned between the safe load and the ultimate strength of iron. Even at the risk, however, of leaving the subject as the author found it, he indulges the hope that the considerations which have been touched upon may induce closer observation and inquiry into the real working properties of iron, as distinguished from its ultimate strength. The question involved in this subject does not appear to be one which admits of solution by a reference to any known natural law, nor does it appear that it can be disposed of by mathematical investigation, but our only safe conclusions must be derived from the results of protracted, varied, and repeated experiment. In the meantime common prudence requires that we ascertain, with as much accuracy as possible, the elastic powers of every given kind of iron proposed for permanent works, and that we then so proportion the parts that the working strain shall never much exceed one half the elastic limit—a ratio which will correspond, according the variable quality of iron, with a load of from 1-8th to 1-4th its breaking strength.

SAGAR AND ROCLIFF'S IMPROVEMENTS IN MOULDING.

A PATENT has been obtained by Messrs. Sagar and Rocliff, of Burnley, Lancaster, for improvements in the mode of constructing the parting plates for producing the moulds requisite in casting iron, brass, and other metals. The invention will be well understood by referring to the engravings. *a* is the parting plate, which is suitable for moulding toothed wheels having five arms or spokes; the parting plate is made of metal or other material. In Fig. 1, the recesses marked *b*, *b*, correspond to the spokes of the pattern to be moulded; the boss and the inner diameter of the rim of the wheel are also produced in recess in Fig. 1. The projections *c*, *c*, are for the gits or runners. When using the parting plates described for moulding wheels, the plate *a* is placed between the boxes *e* and *f*, with the wheel pattern *d* upon it, the position of the wheel pattern being determined by the recesses in the face of the plate, and the two are held in position by pins passing through the snugs of the moulding box, and through the holes in the plate *a*; the sand is then rammed in round the pattern in the usual manner; after this is completed the moulding boxes *e* and *f* are turned over, the whole being held together by the pins; the sand is then rammed into the upper half *f* of the moulding box, and the git hole *g* prepared in the usual manner. The two parts of the moulding box are now ready to be separated, and when the top box is lifted off the plate *a* is removed; the moulder then lifts the wheel pattern out of the sand, after which the two halves of the moulding box are put together, thus completing the mould, into which the molten lead is run in the usual manner. It may in some cases be preferable to fix or attach the pattern to the parting plate instead of using them separately. When the patterns are fixed to one side of the parting plate, they are of course lifted out of the sand with the plate, and as the back of the plate is of the shape of the inside of the pattern required the boxes when put together form the mould.

FIG. 1.

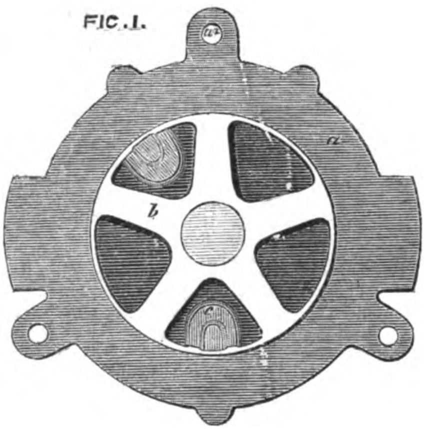


FIG. 2.

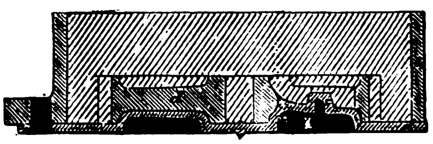
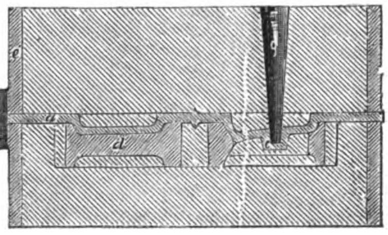


FIG. 3.



CLARKE'S PATENT ADJUSTABLE SCYTHE.

THIS invention, recently patented by Mr. J. G. Clarke, of Brackley, Northampton, consists in forming the crew or heel of a scythe blade with a recess, and in such manner that it may be fixed by a wedge in a hollow socket, which is fixed or formed, by preference, on the end of a tube, which is passed into and fixed in a hole formed up the lower end of the sneath or handle of a scythe in place of forming the crew or heel of a scythe blade with its end turned up at an angle in order to its being fixed as heretofore to a wood sneath or handle.

Fig. 1 of the engravings shows an elevation of part of the crew or heel of a scythe blade and of a hollow socket in which it is fixed by a wedge; fig. 2 is a section of the same. *a* is part of the crew or heel of a scythe blade, in which a recess, a^1, a^1, is formed which corresponds with the length of the hollow socket *b*, which is for the purpose of obtaining strength and lightness fixed or formed on the end of a tube *c*, which is to be fixed to the lower end of a scythe handle; *d* is a wedge which retains the crew or heel within the the socket. It will be seen that the heel or crew of the scythe blade, in place of being turned up at an angle in order to its being fixed in the ordinary manner to a sneath or scythe handle, is only slightly curved near its end, whilst the end is formed with a recess to fit the socket, by which the end of the crew or heel, in place of rising up the lower end of the scythe handle, as heretofore, is formed so as to be held at right angles to the end of the scythe handle.

FIG. 1.

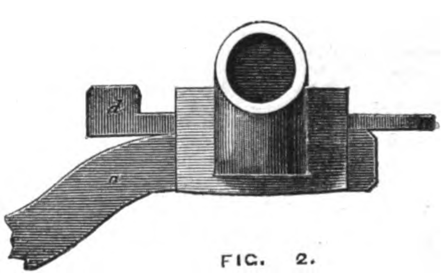


FIG. 2.

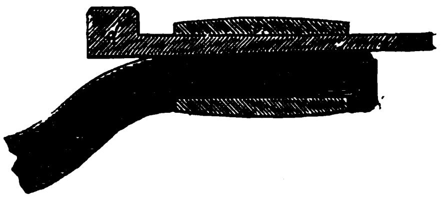


FIG. 3.

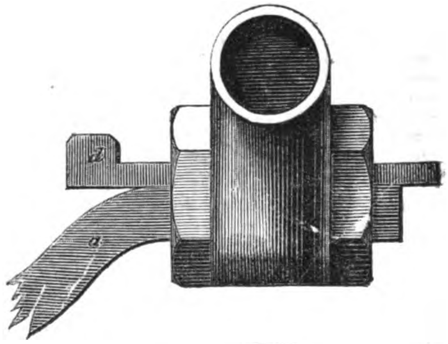


FIG. 4.

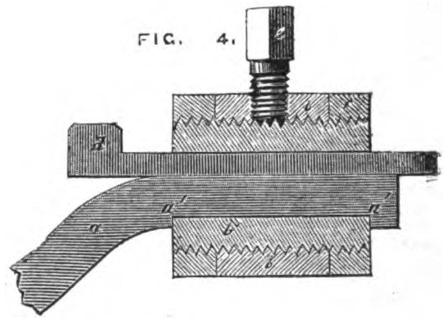


Fig. 3 shows an elevation; fig. 4, a section, wherein *a* is the heel or crew having a recess, as in the previous figs.; *d* is the wedge by which it is fixed within the socket *b*, which in this arrangement is formed of two parts *b*, *b*, which, as before described, is by preference fixed by a short tube to the handle of a scythe.

The internal part is retained by a set screw *e*, and two screw nuts *f*, *f*, as shown, by which the position in which a scythe blade is held may be more nicely adjusted, or the two nuts may be dispensed with, and the set screw only used. In some cases, in place of an ordinary handle, the tube *c* is extended so as to form a tubular metal handle.

LAHOUSSE'S IMPROVED RAILWAY WHEEL.

This invention, just patented by Mr. Lahousse, of Lupus-street, Pimlico, relates to a novel construction of a railway wheel, which will admit of the application of tyres in a cold state, and of their ready removal when required to be renewed.

In the accompanying engravings, Fig. 1 shows the improved wheel in side elevation; Fig. 2 a cross section; and Fig. 3 shews the boss of the wheel in face view, with one of a series of segments, used in lieu of spokes attached thereto.

A is a wrought iron nave, formed with a conical periphery, and having a broad flange at the base of the cone, which flange is to be pierced with bolt holes. In lieu of spokes discs are employed, which are divided radially into segments, as shown. The outer ends, 1 1, of these segments are bent over inwards, so that when the segments are brought together the bent-in or perimetal edges of the discs will butt against each other. If thought desirable, the adjacent edges of the segments may be coupled together by means of a strap piece and rivets. The segments of the two discs are arranged in pairs, and their inner ends are kept apart by means of filling pieces F, which are pierced with bolt holes. Through these filling pieces, and also through the segment, bolts *f* are passed for securing the pairs of segments together. The segments are arranged around the boss A, within the cold tyre C, which is formed on its inner periphery, with a dish-shaped face or annular trough to receive the turned-over ends of the segment pieces. Wedge pieces E are inserted between each pair of segments. These wedges are driven inwards, until the pairs of segments have moved sufficiently radial (by the pressure thus applied to them) to bed themselves firmly in the annular recess formed in the inner periphery of the tyre. When the wedges are driven home and the consistence of the wheel is secured, the nave is bored out, and the projecting end of the wedges E are turned down; an annular plate or cap D covers the outer ends of the wedges, and prevents them working loose; this plate is secured by screw bolts, which pass through the flange of the nave A, through the segments and filling pieces, and through the plate or cap D, and receive on their tapped ends the nut *e e*. When the tyre is worn or otherwise injured, by merely removing the cap D and knocking out the wedges, it may be disconnected from the wheel, and may be readily replaced by a new one.

LAHOUSSE'S RAILWAY WHEEL.

FIG. 1.

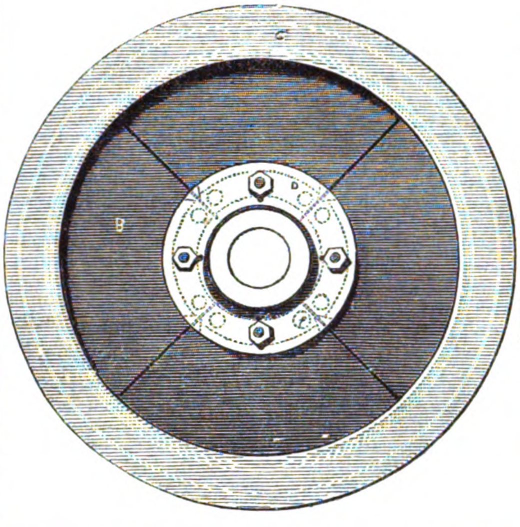


FIG. 2.

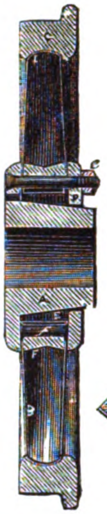
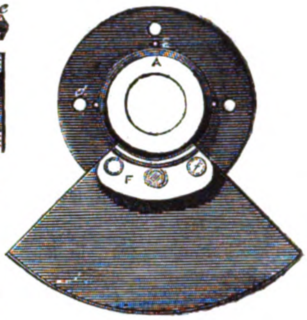


FIG. 3.

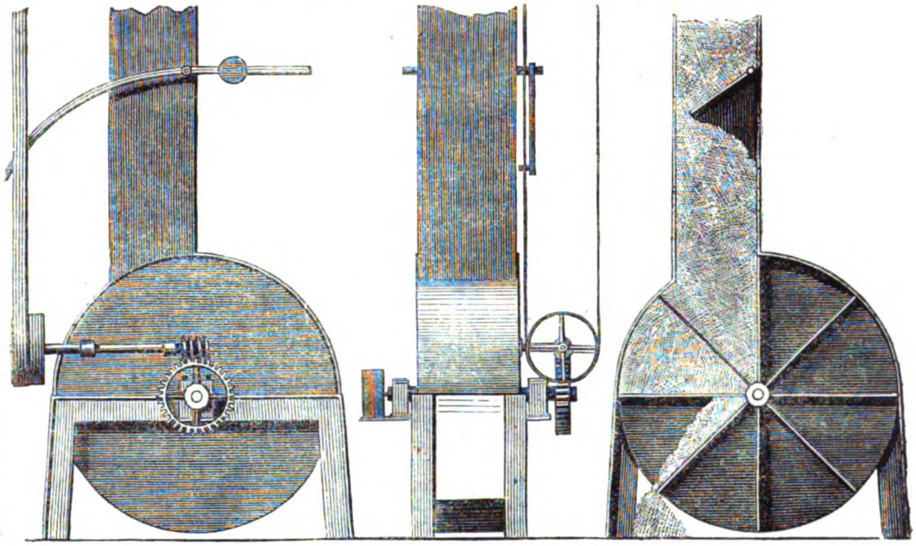


KING'S APPARATUS FOR MEASURING GRAIN.

Mr. T. King, of Spitalfields, has obtained a patent for an apparatus for measuring grain. For these purposes a measurer is employed having two circular ends, the space between the two ends being divided radially by partitions, so as to produce angular measuring chambers around the central horizontal axis, on which the measurer is caused to turn (as illustrated in the annexed engravings.) The axis of the measurer turns in bearings carried by the framing of the machine, the upper portion above the axis being covered in by a bent plate, or cover, in the form of a semicircular arch, which is fixed to the framing. There is an opening through the cover where the lower end of a hollow trunk, or pipe, is attached, which trunk, or pipe, descends from an upper floor, or place from which the grain or other substance descends through the trunk pipe to the measurer. In the hollow trunk or pipe is a valve the axis of which has a weighted lever fixed on it, and such lever is arranged to act on the driving strap (which communicates rotary motion to the axis of the measurer) and causes such driving strap to be moved from the driving pulley on to the loose pulley, when the weight of the lever overcomes the valve, by reason of the supply of malt, grain, or granular substance being insufficient, and the machine will thus be stopped, but so soon as the weight on the valve caused by an increased supply of the substance to be measured is sufficient to overcome the weighted lever, the driving strap will be again moved from the loose pulley to the fast one, and the machine be again put in motion. The driving pulley is on an axis on which there is a worm or screw, which gears with and drives a worm or screw wheel on the axis of the measurer. The malt, grain, or other granular substance is delivered from the measuring compartments as the radial partitions descend below the axis of the measurer. The measuring chambers or compartments are each capable of measuring a bushel or other determined quantity of material.

This apparatus does not require to be attended whilst it goes on measuring. A counting apparatus is applied to the axis, by which the quantity of malt or grain or other granular substance which has been passed through and measured by the machine may be ascertained at all times.

KING'S APPARATUS FOR MEASURING GRAIN.



INSTITUTION OF CIVIL ENGINEERS.

January 20 and 27, 1863.

John Hawkshaw, Esq., President, in the Chair.

The discussion upon Mr. Preece's Paper "On Railway Telegraphs, and the Application of Electricity to the Signalling and Working of Trains," occupied both evenings.

It was observed that two statements had been made in the "Private Press" abstract, which required explanation. The first referred to the system introduced upon the London and North-Western line by Mr. Edwin Clark. In alluding to the use of disconnecting wires it was remarked, that "this plan was thought to be dangerous." By this it was not meant to be implied, that danger was induced to the traffic of the line, but that the wires were liable to cause derangement in the electrical circuit. The second had reference to the instrument recently applied to the Metropolitan Railway by Mr. Spagnoletti, which, though identical in principle with one invented by Mr. Highton in the year 1854, was admitted to differ considerably in detail.

It was thought the necessity for an opportunity of discussing this subject would be apparent, when it was understood that no two lines having their termini in London employed the same system, and that on some lines more than one method was in use. The reports of the inspecting officers of the Board of Trade upon Railway Accidents were also at variance with each other, in this respect. Perhaps the most important point for consideration was, whether lines should be worked by an interval of space, or by an interval of time. The Government Inspectors recommended the former plan, while the managers of the principal railways contended that the traffic could not be carried on under such restrictions, and that reliance must be placed on the latter system.

It was explained that in Dr. Tyer's system, the dial of each instrument was divided into two parts, the upper portion referring to the "up" line, and the lower portion to the "down" line. Each instrument had also two indicators—one red, the other black. The former always showed the last signal sent; the latter that last received, and this was unalterable by the man in charge. No signalman ever sounded his own bell, or gong; and when these were heard, the man knew that the next station wished to communicate with him. As regarded the effects of atmospheric electricity, it was asserted that it had never caused a false signal to be given; and as the red needles were altogether out of circuit, and could not therefore be affected by lightning, the chance of demagnetization from this source was reduced one-half. Further, the needles were not permanent magnets, as in most other instruments, but simple pieces of soft iron, which received their magnetism by induction, from being suspended in close proximity to the coil of wire through which the charge flowed. As to the objection that this system only required one line wire, it was believed to be an element of safety, as well as of economy; for where two or more wires were employed, if one were broken, with persistent currents flowing through the fractured wire, or either of the others, false signals might pass into the instruments; whereas with one wire, should it be broken, no signal could be acknowledged, and thus be made complete. As to the instruments being always under lock and key, it was argued that when any derangement occurred, it was safer to send for the superintendent at once, than to allow the signalmen to attempt to repair, alter, or tamper with what they knew nothing about; and it was considered, that all "terminals" and connections should be under lock and key, as a signalman might put the wires on to the wrong "terminals" which, with persistent currents and needle arrangements, would cause a different signal to be recorded at the distant station to that transmitted.

As the extensive system of telegraph train-signalling on the South-Eastern Railway—the basis of which was "sound upon bells"—had only been cursorily alluded to in the Paper, it was considered advisable to give some further details. The first bells were erected January 22—31, 1852, and at the present time 275 miles of that line were protected in every possible manner, and in a great variety of places, by bells—there being 330 in operation, some connected merely in pairs, others with intermediate bells, and in different ways. Of these, 84 were provided with counting indexes, which showed the number of blows sounded, and the remainder were plain. In some of the signal-boxes there were two, three, and, in rare cases, as many as four bells, which differed in tone, and in the position they occupied. Should the signalman be uncertain which bell sounded, or how many blows had been struck, the index pointed to the number on a dial. It was a simple mechanism—a pair of pallets and a scape-wheel on the arbor, which carried the hand of the index to the precise number of blows struck upon the bell. The total cost on the whole line, had amounted to nearly £3,650, being at the rate of £13 5s. 3d. per mile, including wires, bells, and batteries complete. The hammer, which was attached to the keeper of the electro-magnet, was the only moveable part of the bell apparatus. The signals were given by the number of blows struck, and one fundamental and essential condition was, that every signal should be correctly repeated before it was allowed to be complete. In every system of train-signalling, it was essential that a good understanding should be established between the men at two neighbouring stations, A and B. On the South-Eastern line, the four telegrams which were necessary between them were—1st, "May I send a train," given by station A, striking one blow to B; 2nd, "Yes, you may," one blow struck back by B. Nothing could be simpler. The blow was a loud one, distinct in its sound, and readily understood. The third communication would be from B, 3rd, "The train you sent is in safe," intimated to A by three blows; to which the fourth message sent back from A, 4th, "All right, I understand train is in," A repeating B's three blows. These four signals were booked by each station; the time at which each signal was completed being entered in the proper column, so that a double permanent record was secured. On the three lines on the west side of the London viaduct, run over by the South-Eastern, the Brighton, and the Croydon and Crystal Palace trains, where the bells alone were used, the average number of trains on week-days was 196, and in one year 78,676; and on the day of the Forester's fête at the Crystal Palace, August 19, 1862, 535 trains were booked, as having been *bona fide* signalled by one pair of bells. It was satisfactory to be able to add, in proof of the efficiency of this system of train-signalling, that no collision had ever occurred on the portions of the South-Eastern line where the bells were in use.

One peculiarity about these instruments was, that they appeared to be the only kind of telegraph that could be used with balanced currents. When the bells were arranged in this way, the guard of a train which might have become disabled between two stations, had merely to fasten a wire to the bell-line wire, and each time he touched a rail with the other end of the wire, the bells at the adjacent stations on both sides were rung. No batteries or apparatus of any kind had to be carried with the train. The system of signalling was, however, so efficient on the South-Eastern line, that such a use of the bells was hardly to be looked for.

It was believed that the South-Eastern Railway Company carried out the "block" system of telegraph train-signalling to a greater extent than any other in the United Kingdom; and that, as it was the only system which could be followed with any degree of safety, especially where the trains were run at high speeds and at irregular intervals, to suit the emergency of the traffic, it ought to be made obligatory upon every railway company. On the other hand, it was argued that, upon a main line of railway, the use of the "block" system would be disadvantageous, as being liable to lead to greater detensions than were called for upon any ground of public safety, and as having a tendency to lessen the caution necessary to be observed by engine-drivers. Although there might be portions of a railway so crowded with traffic, that the telegraph would become an essential element of safety, and where this system might answer very well, yet so long as its aid could be dispensed with, there was a positive advantage in ignoring it, and in depending upon the ordinary mode of signalling; for the "block" system required such a greater number of signals and signalmen, as to increase the liability to mistake, and so render the alleged additional safety very questionable.

It was remarked, that both the ear and the eye were apt to be misled—the ear especially; and that as the continual and monotonous repetition of the same sound must have the effect of confusing the mind, the bell-system could not be trusted. The eye, too, was liable to error, and the constant motion of the needles to produce weariness. It has been ascertained, that the best clerk in the Electric Telegraph Company's service made a mistake once in five thousand five hundred and eighty times. Although in the simple work of signalling trains "in" and "out" the mistakes would be fewer in proportion, yet it was generally admitted, that the Electric Telegraph was a dangerous instrument to trust, as the primary agent in the working of a railway. As an auxiliary, however, telegraph train-signalling was believed to be invaluable, and its application indispensable; for it enabled managers to expedite under extraordinary circumstances, the passage of trains, to economise time and money, and as a corrective of other signals it was productive of increased safety.

The several instruments by means of which the "block" system could be carried out were then described. In reference to Mr. Tyer's instrument it was remarked, that although perhaps one wrong signal might be sent by a current of atmospheric electricity, yet no series of false signals could be transmitted, as might happen if the magnetism of a needle were reversed. In this system batteries were not permanently closed, and the current was not kept constantly flowing through the wires; consequently the batteries did not deteriorate so rapidly as in those systems in which a permanent current was maintained. But this instrument had what might be considered a serious fault, for, to send one and the same signal, two different buttons had to be used at two different times, according to the position of the red pointer; and if the wrong button was chosen, the needles showing the condition of the line would be altered when they ought not to be moved. In Mr. Preece's instrument there were several hinges, and at each there was a liability to stick. In addition there was a cog-wheel and rack, and the great motion of the semaphore arm, as compared with the small motion of the armature, placed the latter at such a disadvantageous leverage, that the slightest check to the end of the semaphore arm would prevent the motion of the armature, whether moved by the current, or by the weight, unless very powerful currents were had recourse to; and the utmost force caused by the electric current was very feeble. Moreover, the working parts were exposed to dust and dirt. It was thought that Mr. Walker's bell-system, and other instruments which did not leave a permanent visible signal, threw too great a strain on the attention of the signalman. Mr. Edwin Clark's system, as in operation on the North Western Railway, was believed to have fewer practical objections, and therefore to be safer, than any other. The instrument he employed was made of a common magnetized needle, balanced on two pivots. There was the least possible amount of friction to restrain the motion of the needle, the action was of the simplest kind, and the instrument was scarcely liable to be deranged.

It was urged that no system of mechanism intended for train-signalling should be capable of being used for any other purpose. Also, that if the distances between the signal stations were made to correspond with the maximum amount of traffic likely to arise on any particular section of a line, the objection to the block system, that it unnecessarily delayed the traffic, would be at once removed. It was singular that, whilst it was attempted to ignore the advantage of the block system on the open line, its importance was admitted in tunnels, where the greatest caution was required. One great defect in all the systems previously noticed was that arising from the failing of the batteries. In Professor Wheatstone's arrangement of magnetic signals, as there was no voltaic battery, there could be no diminution of power; so that the instruments would be as available twenty years hence as at the present time. They also possessed a great surplus of power beyond what was required for train signalling; and could be, and had been, arranged to give a large number of signals, in addition to the two simple ones of "train on line," or "line clear."

The ordinary station signals now in use gave three signals—"all clear," "danger," and "caution." As they were almost invariably maintained either at "danger" or at "caution," the latter signal was frequently taken to mean "all clear," and being thus disregarded, not only had it no value, but an element of danger was introduced. On the Great Western line, the "caution" signal was given by a policeman with his hand on peculiar occasions only, and when really required.

It had been ascertained by experience, that the signalmen preferred the system of permanent signals to those in which the same wires were used for both lines of rails, and by which trains were simply "reported" as in or out of a tunnel. As an illustration it was mentioned that, at Springwood, near Huddersfield, where there were three cabins with telegraphs, so much impressed were the men with the necessity of having a permanent signal, that they invented one of their own, consisting of a piece of red rag placed on the instrument when there was a train in the tunnel, and removed when it was reported clear. This red rag had now been replaced by a card. Bells to indicate "line clear" or "line blocked" seemed more objectionable than the system of temporary needle signals, as the eye was more to be depended upon than the ear. The repetition of signals was the best safeguard against error, and against failure from demagnetization, reversal and accident to the wire, or to the apparatus from any cause.

It was remarked that the Metropolitan Railway was worked entirely by telegraph; the trains being controlled by station semaphores, moved by the signalmen. During the first three weeks it had been opened, more than half a million passengers had been conveyed over the line, and on one occasion the number amounted to nearly forty thousand within fifteen hours, and no mistake had occurred in the working. The instruments employed were the invention of Mr. Spagnoletti. In their normal condition, when not in action, or in case of derangement, neither signal was distinctly visible. This line was blocked by pressing a red key, when the disc at both stations showed the red colour, and the words "train on line." The colour indicated by the disc was always identical with that of the key upon which the finger was placed. The white disc signal was given for "line clear." Either could be seen from any part of the signal-box with a moderate light, and it was considered that the marked distinction offered by the broad discs of different colours (red and white) constituted of itself an advantage over the needle signal.

With regard to the working of single lines of railway, it was contended that the only system which would ensure absolute safety was the "train staff." In the manipulation of the telegraph, one mistake might be fatal, whereas the "train staff" could scarcely go wrong, as to produce a collision there must be the consentaneous mistake of three men—the station master who had charge of the staff, the guard, who received it from the station master, and the engine driver, who could not move till the staff was produced. To this it was replied, that the "train-staff" system had been found by experience, in Ireland, to be exceedingly defective, as even when running only five trains per day in each direction, it was almost impossible to repair defects on the line without working in the night, or to run extra trains at times of fairs and markets. On the other hand, it was asserted that the "train staff" had answered well in a great number of cases, both in England and Ireland, and that not a single accident had occurred, from trains meeting one another, where it was employed; whilst where telegraph instruments had been used without a "train staff," there had been a number of accidents under various systems of working, in consequence of mistakes and misunderstanding on the part of the persons in charge of the instruments. In answer to this it was observed, that the alleged inefficiency of the telegraph in the working of single lines was due, as far as could be ascertained, more to the eccentricity of genius on the part of the railway officials, than to the system itself when worked under proper guidance; inasmuch as in India about 2,000 miles of single lines (or considerably more than all the railways in Ireland put together), were worked by the telegraph with comparative freedom from accident. Thus, during the year 1860, out of 4,225,240 passengers carried in India, none had been killed from causes beyond their own control, while only 0.94 per million had been injured. According to the English returns for the past year, the passengers carried were 173,721,139, the number killed averaged 0.26 per million, and those injured 4.50 per million. Again, one-half of the accidents on English lines arose from collisions, while on the Indian railways one-seventh only emanated from the same cause. Theoretically, no doubt, the "train-staff" led to greater safety than any other mode of working. But persons might be preserved from railway accidents by not going upon a railway at all; and the "train-staff" system was an approach to doing away with railway travelling. As a system it simply meant that, provided a company confined itself to one staff, it would also limit itself to one locomotive; and so long as only one locomotive ran upon a line there could not be any collision. But it was obvious that, under that system, trains could not be started from the same end of the line at short intervals of time, and therefore it was considered wholly inapplicable to any railway on which the traffic was large.

It was stated that, in the year 1854, Mr. C. V. Walker constructed a semaphore electric telegraph for train signals, which exactly coincided with that described by the author. It consisted of a galvanometer needle, with an ivory arm on the top of a semaphore pole instead of an outer needle, a persistent current causing the arm to be retained in one of its positions. This instrument was used at Tunbridge for eight months, and was shown at the International Exhibition at Paris, in 1855. At the same time Mr. Tyer exhibited a pair of disc signals, coinciding in many points with the French plan of using discs. Experiments were tried on the latter system on the Paris and Strasburg line, and at present there were about 150 sets of these instruments at work on the Continent.

In reply, upon the discussion, it was observed, that the first great question was the advantage of the general adoption of the telegraph in the working of railways. Those who had spoken seemed to confirm the opinion expressed in the Paper, that the telegraph was chiefly valuable as an auxiliary agent. Railway companies did not appear at present to have arrived at any definite conclusions, as to the point of demarcation where it was necessary to abandon the "time" system, and to seek the aid of electrical signals. It having thus been determined that, in certain localities, and under certain circumstances, a system of electrical signalling was essential, the question arose, whether the telegraph was to be dependent upon the organs of sound, or upon those of sight. Although the South-Eastern, the London, Chatham, and Dover, and the North-Eastern Railway Companies employed bells, it was contended that the weight of the evidence was in favour of visual, as against aural signals. The next point for consideration was, whether these visible signals should be produced either in a permanent, or in a transitory manner. As the use of transitory signals necessitated the employment of record books, it was believed that they were disadvantageous, as record books could never be trusted. In discussing the question whether these permanent signals should be obtained by the use of continuous, or by momentary currents of electricity various natural and artificial phenomena were referred to, which disturbed the correct working of telegraphic circuits. The first and greatest enemy was atmospheric electricity, and its most frequent effect was one resulting from the inductive action of a cloud charged with electricity. Such effects were stated to be comparatively harmless on the semaphore, to be easily remedied upon the needles; but to be highly dangerous, as giving false signals, on Mr. Tyer's and other instruments worked by momentary currents. Deflection, or "earth's currents" also seriously affected circuits worked by momentary currents. There were also interruptions arising from accidental and artificial causes, such as the wires coming into contact; these would produce false signals on instruments worked by momentary currents, while those actuated by continuous currents would remain unaffected.

With regard to the invention of the Semaphore Electric Telegraph, it was remarked that both Mr. Walker and Mr. Preece had been anticipated by Mr. Ward, in 1847. And although the idea conveyed in the two instruments in question was similar, their mechanical construction was different; for Mr. Walker's was a simple needle, whilst Mr. Preece's was a practicalr railway signal. The author did not, however, claim the mere invention of the semaphore; but the assimilation of the electrical to the ordinary line signals of the particular railway upon which they might be fixed, the method by which electrical signals were simply worked as distant signals, and the reduction of the whole system to one uniform plan.

ON OBTAINING FRESH WATER BY EVAPORATION.*

By Mr. George Russell.

When water is distilled by the usual method of merely condensing the steam, it is well known that, from the absence of its natural quantity of air, the taste is so obnoxious as to render it disagreeable, if not unfit for use, immediately on leaving the apparatus, or even after it has been for a considerable time exposed to the atmosphere. Even if the process of exposing it to the atmosphere were sufficiently effective, it would be most inconvenient on board ship, where a supply of fresh water is one of the most important requisites. From the intense action of distilled water on metals, considerable care is necessary to prevent it becoming impregnated with poison from the metallic surfaces with which it may come in contact. To obviate these defects by supplying the water with air during the process of distillation, the writer has applied the principle of induction by means of a steam jet—in a manner somewhat analogous to the blast pipe of a locomotive engine.

Fig. 1 of the engravings annexed is a section of this contrivance, and Fig. 2 a section of an ordinary worm distilling apparatus, with this "distil-aërator" (as it has been named) attached. The steam enters at S, its admission being regulated by the stop-cock. In the cup below the cock there is a diaphragm at right angles to its axis, and the steam nozzle reaches nearly down to this diaphragm, which is formed with a larger nozzle or tube concentric with the steam nozzle, and projecting downwards to about half the depth of the cup. Above the diaphragm there are apertures, A (Fig. 1), for the admission of air, with a cover, or valve, for shutting when the apparatus is not in use, or for regulating the admission. When steam is admitted at S, and, as it leaves the steam nozzle and passes into and through the lower nozzle, a current of air is inducted through the apertures at A. This mixture of steam and air passes through the worm, and combines in the process of condensation, any superfluous air being discharged along with the fresh water at W (Fig. 2). As already stated, the immediate design of this contrivance is to aërate the water, and thus bring it to the natural condition of fresh water; but, from experiments, it is found that, besides this, the efficiency of this apparatus as a condenser is greatly increased from two causes: first, the rush of air in contact with the steam assists, to a considerable degree, in its condensation; and, secondly, the total surface is rendered available for condensation. In explanation of this, suppose, as in the ordinary distiller, no air apertures to exist at A, the steam being condensed in the worm produces a partial vacuum, and the fresh water collects in the lower part of the worm, until a column sufficient to balance the partial vacuum is produced. The lower portion of the worm is thus inefficient as condensing surface in ordinary distillers; but when air is admitted at A, the vacuum is destroyed, and all the surface is rendered efficient.

The experiments have shown this method of aërating the water to be most efficient, the water being discharged cool, sparkling, and as agreeable to the taste as spring water.

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* Proceedings of the Institute of Engineers in Scotland.

From a chemical analysis, by Dr. Penny, of the water distilled from that in Greenock Harbour by this system, on board the ship Orissa, it is found to contain 7 cubic inches of air per imperial gallon. Comparing this with the water as supplied to the inhabitants of towns—in Aberdeen the water has 7·25 cubic inches, and in Perth 6·8 cubic inches in the same quantity. Loch Katrine water has 8·25 cubic inches per imperial gallon. The average of several of the other principal towns in Scotland is about the same as the water distilled from sea-water by this apparatus.

FIG. 1.

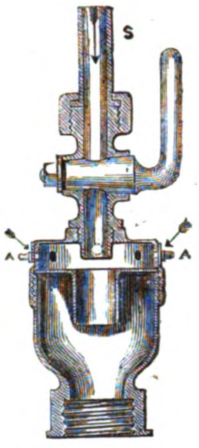
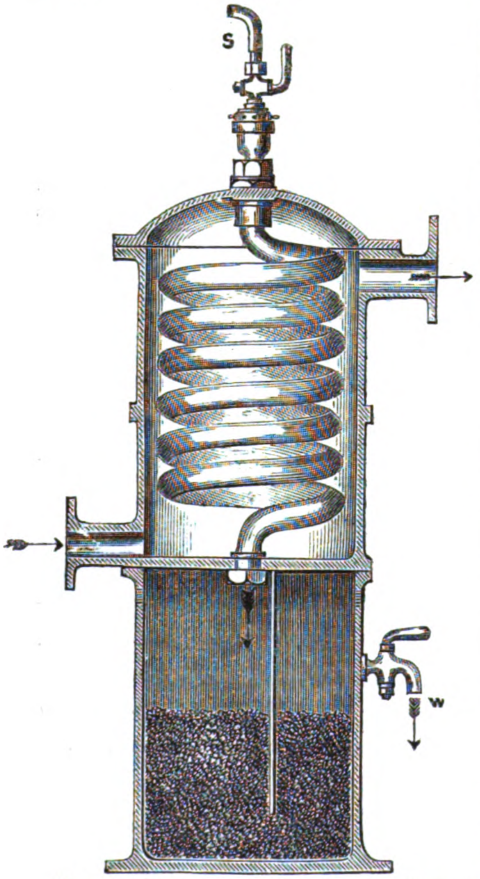


FIG. 2.



Two distil-aërators of different sizes were exhibited; and in the discussion which followed—

Dr. Macquorn Rankine asked if Mr. Russell was acquainted with Dr. Normandy's apparatus for distilling water?

Mr. Russell was acquainted with its general features, but could not give a detailed description.

Mr. James R. Napier said he had seen Dr. Normandy's apparatus at work, but this was a much simpler arrangement. The water he tasted from Dr. Normandy's apparatus, if not passed through charcoal, was quite oily and undrinkable; but after passing through the charcoal filter it was excellent. Dr. Normandy stated that the charcoal filter was of little use unless the water was aërated. He believed this little apparatus of Mr. Russell's would be very valuable. He had been told by the eminent shipowner, Mr. Henry Green, that formerly when they carried Coolies they had always a great many deaths every voyage; but after getting Dr. Normandy's apparatus the deaths were very greatly reduced. For emigrant ships, therefore, such an apparatus as that of Mr. Russell must be very valuable. Dr. Normandy's apparatus would, with the same fuel, produce twice as much distilled water as the common distilling apparatus, such as that to which Mr. Russell had shown the application of his aërator. The adaptation of apparatus similar to Gifford's injector or Thomson's jet pump for aërating the water, was very ingenious.

Mr. Russell said that they had found very little difference with or without charcoal.

Dr. Macquorn Rankine said he believed that was mainly determined by the kind of water distilled. If there was no organic matter in the water, then it was not absolutely necessary to filter it through charcoal.

Mr. James R. Napier said that sailors of the steamer Lancefield, during one of her voyages to the West Highlands, were under the necessity of drinking the condensed steam from the cylinder jacket without any filtering. Some of them fancied it was bad; but he himself did not find it disagreeable, and it had not an oily taste.

Mr. Downie remarked that one of the peculiarities of this apparatus was, that it was applicable to distilling apparatus of any kind, and it looked as if it would be of little cost, and hence the value of its application.

Mr. Russell, in answer to questions, said it could be applied to any apparatus for distilling water, such as the steam pipe in the paddle-box of a steamer, and in any position. Ten gallons of fresh water an hour could be obtained from the smaller distil-aërator exhibited, the condenser for which was 1 ft. in diameter; by the larger 40 gallons could be got in the hour. It worked at any pressure. There was no objection to letting in any quantity of air, as any superfluous air was discharged with the distilled water. Those who had inquired as to the cost of the apparatus he must refer to Messrs. Alex. Chaplin and Co., Cranstonhill, Glasgow, who were manufacturing the distil-aërators and condensers.

Mr. Brownlie said it had been remarked that it might be used as a condenser for anything; but this was not quite accurate, as it would not do for spirits, as a large amount of them would go away with the air.

Mr. Gilchrist said that in Messrs. Allan's boats Normandy's apparatus had been fitted up, but was a little troublesome to keep in order. This, however, looked very simple. Normandy's also was very expensive, and this looked much less so.

Dr. Macquorn Rankine remarked that a number of the members had expressed their sense of the merit of this contrivance. He thought it must be obvious to every one, how efficient and how easily managed this apparatus would be.

After the last meeting of the Institution of Civil Engineers, a model of a railway break was exhibited by Mr. W. G. Creamer, of New York. This plan was stated to embrace—first, an arrangement of compensating, or balanced breaks, actuated by one lever, and distributing the pressure equally on all the wheels, with a small expenditure of power; secondly, an attachment of reserved power to the breaks of every carriage, in combination with a non-elastic signal rope, so as to enable the driver instantly to apply every break in case of danger; or, on the separation of the train, or any part being thrown from the line, the breaks would apply themselves automatically, as each carriage was entirely independent of all the others, and the breaks were available wherever they were placed in the train.

Meetings for the Week.

MON.—*British Architects*, at 8 p.m.
Royal Geographical Soc., "Explorations in Australia," by Messrs. Stuart, Landsborough, and McKinlay, at 8.30 p.m.
Medical, at 8.30 p.m.
London Inst., "On Music," by J. Pottman, Esq., at 7 p.m.
TUES.—*Royal Inst.*, "On Animal Mechanics," by Prof. Marshall, at 3 p.m.
WED.—*Soc. of Arts*, "On the Influence of Social Institutions upon the Progress of Art in this and Foreign Countries," by G. R. Burnell, Esq., at 8 p.m.
London Inst., "On the Zoology of Warm-blooded Vertebrata," by C. C. Blake, Esq., at 7 p.m.
THUR.—*Antiquarians*, at 8.30 p.m.
Royal Inst, "On Chemical Affinity," by Dr. Frankland, at 3 p.m.
Royal Soc., at 8.30 p.m.
FRI. — *Royal Inst.*, "On Fogs and Fog Signals," by Dr. Gladstone, at 8 p.m.
London Inst., "On Economic Botany," by R. Bentley, Esq., at 7 p.m.
Architectural Assoc., "Oriel Window, or Bay Window with Shutters."
SAT. — *Royal Inst.*, "The Science of Language," by Prof. Max Müller, at 3 p.m.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

To insure insertion in the following number, advertisments should reach the office not later than 5 o'clock on Thursday evening.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of his good faith.

RECEIVED.—Capt. Norton—J. M.—F. F.—J. R. T.—L. S.—W. B.—Messrs. B. & Co.—C. B. A.—D. & Sons.

T. P.—(Manchester). Thanks.

B. L.—You had best advertise.

A. F. B.—We know of no work on the subject.

KESSEL.—The plate of your boiler ought not to be overheated at the point shown. It is probably too heavily fired.

F. L. P.—Your proposed scheme is absurd. We would strongly advise you to carefully peruse some good work on mechanics.

S. T. (Lincoln).—Send your application, with testimonials, &c., to the Secretary of the Admiralty, Steam Branch, Whitehall.

CATAPULT (Bradford).—The formula given by writers on artillery for calculating the velocity of recoil in ft. per second is $\frac{Vw}{W}$ wherein V is the initial velocity of the shot in ft., w the weight of the shot, and W the weight of the gun with its carriage. It is, however, a remarkable fact that the recoil increases with the elevation of the gun. In the case you put to us, the recoil would probably be more than 20 ft. A 32-pounder, fired at an elevation of 4 deg., gives a recoil of about 19 ft. on a horizontal platform.

W. W. (Portsmouth.—We fear that you must be very inexperienced if you think that the bringing out of any new scheme for "marine propulsion" would "commemorate the great event of the Royal Union," or could be "made to share in our national honours." There are nearly 4,000 patents taken out every year, only 3½ per cent. of which are prolonged to the full extent of the 14 years. Do you think that your invention is one of the grains of wheat in this annual mass of chaff?

W. F. (Caldy, South Wales).—You will find in one of the stanzas of the "Ancient Mariner," written by S. T. Coleridge nearly 50 years ago, the complete idea of the "Pneumatic Despatch." You might have had a similar idea "more than 20 years ago," but there is a great distance between an idea and its practical realization. The engineers of the Pneumatic Despatch Company are Messrs. Rammell and Clarke. Mr. Latimer Clarke is the patentee of the apparatus.

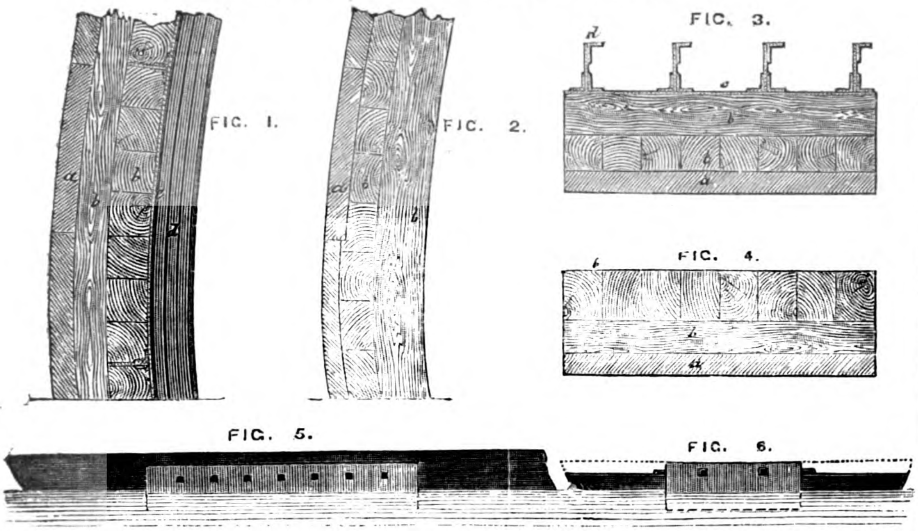
Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

COMBUSTIBLE IRON-CLADS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE.

SIR,—My last letter was written some days before the debates on the Navy Estimates. It questioned the conduct and motives of the Admiralty in appointing Mr. Reed over the heads of experienced and talented master shipwrights, and in contemplating the construction of a fleet of combustible iron-clads. It is, in my mind, impossible to separate the appointment and the proposal, and


SECTIONS OF THE "DEFENCE" AND "ENTERPRISE."

I am glad to find that members so competent to arrive at sound conclusions as Sir John Pakington, Sir Frederick Smith, Mr. Cobden, Mr. Laird, and Sir S. M. Peto take the same view of those questions as that which I presented to your readers. The whole matter is in good hands; and there is little danger of the men of wood, with the aid, even of Mr. Reed, carrying their point. After the suspension of the resolution for the construction of wooden iron-clads, I should say no more on the subject, were I not well acquainted with the dogged determination at Whitehall to carry that project into execution; I, therefore, think it may be of service to the cause of iron to illustrate, with diagrams, the principle of Mr. Reed's system, as well as the comparative force of resistance of an iron and a wooden iron-cased hull.

These sketches represent sections of the "Defence" and "Enterprise," both partially protected on the plan of the "Warrior." They refer only to the armour-plating and fighting-box, and not to the design of the vessels. Figs. 1 and 3 are sections of the broadside of the "Warrior," which is similar to that of the "Defence." *a*, the armour plate, 4½ in. thick; *b*, teak backing, 18 in.; *c*, iron skin; *d*, iron frames. Figs. 2 and 4 are corresponding sections of the broadside of the "Enterprise," which Mr. Reed calls a belt, as if it were some new conception of his own; but it is nothing more than the armour-plated portion of the hull from under the water-line to the gunwale, *a* being the armour plate, 4½ inches thick, diminishing to 3 inches at the bows and stern; *b*, the wooden hull, 18 inches thick. The difference between the two systems is simply that the iron skin and the iron frames, or ribs, marked *c d*, on Figs. 1 and 3, which form the hull of the iron ship and constitute the chief element of rigidity and strength to resist projectiles, are totally wanting in the hull of the wooden ship (Figs. 2 and 4). The latter, in fact, possesses only the strength of the armour plates and backing (*a b*) of the former. It will be seen at a glance how vastly inferior in force of resistance to the impact of shot the side of the "Enterprise" is to that of the "Defence" or "Warrior." The bulge formed at the back of an armour plate by a shot, which does not penetrate, will drive splinters from a wooden hull between decks, an effect which an iron hull effectually prevents.

In testing plates on the sides of wooden ships at Portsmouth that result is constantly produced; whilst the iron skin and frames of the "Warrior" section, in the experiments at Shoeburyness, not only opposed an impassable barrier to 68 and 110-pounders, but arrested the passage of the Armstrong 150-pounder shot, after they had penetrated the armour plate and backing. In the event of the armour plate being penetrated with incendiary projectiles, of which the Whitworth shell has proved the practicability, the hull of the "Enterprise" would be in flames; but if the wood backing of the "Warrior" were ignited, there would still be a wall of iron for the protection of the interior of the vessel, and the fire might be extinguished. Fig 5 is a sketch of the broadside of the "Defence," and Fig 6 of that of the "Enterprise." The object of these diagrams is to show that Mr. Reed's battery is, in principle, an imitation of the "Warrior" or "Defence" fighting-box. The central portion of the gun-deck, equal to about one-half the length of the ship, is armour-plated at the broadsides, and separated from the ends by bulkheads athwartship, which are also armour-plated. The difference in the build is that the gun-deck of the "Warrior" and "Defence" is continued from the bulkheads to the stem and stern, but without the sides being armour-plated; whilst the upper works of the "Enterprise," at the bows and skin, are so arranged, that, when in fighting trim she can point her guns fore and aft through ports in the athwartship bulkheads. Her armament will consist of four 110-pounder guns, two of which can be fought on each broadside, or through ports pierced in the armour-plated bulkheads fore and aft. She is pierced for eight guns, and carries four. The sea-going properties and speed of this vessel cannot be determined until she has been tried at sea. Considering her light draught and the weight she will carry above the load-line in broadside and battery armour and armament, she may be top-heavy, and roll and pitch considerably, in which case the manner in which she is constructed fore and aft will expose her to ship heavy seas, and make her anything but a dry sea-boat.

It is singular with what pertinacity the Admiralty assumes, that, serviceable vessels of the smaller classes cannot be built of iron. Doubtless, the wish is father to the thought; and we must suppose they don't wish to build them, and will not abandon wood except by compulsion. It is a fact, that Mr. Reed's original design of an "Enterprise," was for an iron vessel; but the plan did not, in that material, find favour in the Comptroller's department. It was not until Mr. Reed modified his design and contrived the ingenious device of a "wooden-bottom with iron top-sides," that he became the man of the situation. The stores of timber were accumulated in the dockyards, and the shipwrights were out of work. There was a plethora of wood, and no employment for labour. Mr. Reed came to the rescue, and we know the result. But he committed a fatal blunder. The most valuable characteristic of an iron ship is incombustibility—immunity from destruction by incendiary shells. In designing "wooden-bottoms," he sacrificed the essential condition of an iron-clad. Enough on this subject. Honest members are attentive to the moves of the game. The Admiralty are checkmated, and not likely to carry out their intention of building wooden ships.

CIVILIAN.

THE CHIEF CONSTRUCTOR OF THE NAVY.

SIR,—A great deal has been said in and out of the House of Commons on Mr. Reed's appointment as Chief Constructor of the Navy. The appointment has been condemned, because Mr. Reed has been lifted over the heads of other and older men, and because the time-honoured arrangement of promotion by seniority has been disregarded. Now, I know nothing of Mr. Reed beyond that he is an acknowledged scientific authority on naval construction, and that he has in whatever he has undertaken exhibited considerable energy. But I imagine that his Grace the Duke of Somerset has reasons for believing that Mr. Reed possesses qualities fitting him for the post. For years past, our public writers and economical reformers have been stating that the public interests have been sacrificed to red-tape; that men have been appointed to offices for which they were particularly disqualified; that old men have occupied posts that required the energy of young men to worthily fill; that square men have been put into round holes; that the circumlocution-office of the Admiralty and other departments is a disgrace to us as a nation; and that we required a revolution in the manner of doing our national business. These and similar things have been said again and again, until we are tired of hearing them. Besides, all acknowledge that the statements are true. Well, the Duke of Somerset has apparently taken the advice which has been so plentifully offered, and selected a man for an important post without consulting the "old fogies" and "time-honoured arrangements." He did not ask whether Mr. Reed had been so many years in the service, whether he had been stuffed full of experiences of the last century; but he selected Mr. Reed because he thought he was the best man for the work to be done, and I think, as an outsider, that he deserves credit for such a courageous exercise of power. Mind, I am not saying whether Mr. Reed is or is not qualified for the duties imposed upon him by his new office. I assume that he is qualified, and if so, I hope the Government will be uninfluenced by the carpings of small critics, whether in the Parliament or the press.

I am, &c.,
A CORNISHMAN.

PRESSURE GAUGES.

SIR,—In the notice of the report of the "Association for the Prevention of Steam Boiler Explosions, &c." in your impression of the 20th inst., I observe some remarks on the four kinds of pressure gauges in general use—viz., the mercurial column, the mercurial differential gauge, the dial gauge, and the compressed air gauge. For high pressures the two former kinds of gauge are impracticable. The dial gauge, consisting principally of a metallic spring, loses its accuracy by continued working, and is often very difficult, if not impossible, to repair and adjust. The compressed air gaunge is unfavourably mentioned in the report as one "in which a syphon column of mercury as a piston acts upon an air cushion, and is found to be universally incorrect, and quite unworthy of confidence." I believe these faults to be indisputable with reference to the above described construction of compressed air gauge.

A compressed air gauge, the patented invention of Mr. Alexander Allan, of Perth, has been in extensive use during the last three years, and with the most satisfactory result. It consists of a pillar of brass, having within it a chamber of peculiar form, in order to give equal divisions on the graduated scale of the gauge. This chamber is connected, by passages at top and bottom, with a glass tube. The exact quantity of air necessary for its correct working is measured from a cock at the bottom of the gauge. Instead of mercury, water is used in this gauge, and pressure is indicated by the surface of the water in the glass tube forming an index to the graduated scale engraved on the polished exterior of the brass pillar.

Perth, Feb. 26, 1863. J. M.

MR. REED'S SHIPS.

SIR,—The increasing employment of iron in shipbuilding indicates undoubtedly great and beneficial progress in the art, and yet I cannot think it wise and reasonable to denounce the construction of wooden vessels universally, although your correspondent "Civilian" encouraged me by his example to do so. This is mere partizanship, and not judicious advocacy. Surely, the advantages belonging to wood which "Civilian" very fairly cites—the speed which the capability of being coppered materially tends to produce and to perpetuate, and the superior strength of the ship's bottom as against local injuries from grounding in shallow waters, or from striking against sunken rocks or coral reefs in comparatively unknown seas—are paramount reasons why our ships of war of the lighter class should be built of wood. And especially are these reasons enforced, when we consider that the commanders of these vessels must necessarily be venturesome in the execution of daring enterprises, and that they are called upon to do lengthened service in all parts of the world, where ports in which, to refit or even to clear away the weeds and barnacles, which are the pests of iron ships, are not to be found.

Surely, considerations of comparative economy cannot be allowed to compete in importance with the efficiency of vessels often engaged in services where objects of high political interest, or even the national welfare, may be at stake.

Now, whether ships of this class—such as the "Enterprise" and the "Favourite," which Mr. E. J. Reed, the chief constructor of the navy, has designed, and being about 1,000 and 2,000 tons, with two and four years respectively—can be made invulnerable, or at least as little vulnerable as the "Warrior," is a distinct question from that of the material with which they are built; and if these ships fail in the matter of defence, or in their general efficiency as cruisers, it will not be because in the main they are wooden vessels, but because it is attempted to unite in them qualities which, to any valuable amount, are in truth incompatible with each other for all ships below, say 4,000 tons. There is, avowedly, a compromise of sterling properties in these vessels; speed and coal carrying capacity on the one hand, and efficient armour defence on the other, are sacrificed to a considerable extent each for the other. Lord Clarence Paget declared in the House of Commons that it was not shot but shell that it was hoped they would repel; and Mr. Reed announced at the outset that it was not intended they should be swift vessels. It is not necessary, therefore, that as to the matter of defence, their mode of construction should be subjected to "the target trial for the settlement of this point," as suggested by "Civilian." The point is not in dispute, it is a compromise. No ship built wholly of iron which your correspondent could devise, though defended with armour of unusual thickness, supported by his wonder-working "rigidity of iron framing," could stand the test, and at the same time possess sea-going qualities worth having, the condition to be observed being this, that the tonnage of his vessel shall not be greater than that of the "Enterprise." We can no more compass impossibilities with iron than with leather; it will not suffice for everything.*

Let me not, however, be supposed to impute blame to Mr. Reed and his "*enterprise.*" His ingenious attempt to do what he can in the way of compromise for the class of vessels which he has taken in hand is very praiseworthy, and the experiment is well worth making for the sake of seeing how much can be effected on that principle. He will have a solid, compact shell of resistance in his hull, and more capable at a distance of withstanding the concussion, even of heavy shot, than "Civilian," I imagine, would allow, although certainly liable to *penetration* at close quarters, even from a 68-pounder. A defence consisting wholly of iron would not, in my opinion, resist concussion equally well, supposing its weight to be the same. Such vessels must keep their distance, and depend upon their own ordnance being of longer range and of greater weight in the projectile. They must keep their distance if they can, for speed is power; but, unfortunately, they will not be able to do much in this way through steaming; they must depend greatly on sailing properties, and accordingly Mr. Reed has, it is said, given to them beautiful swift going forms, but whether with a special view to their being powerfully rigged I do not know. A small iron-clad, with little speed, is a helpless thing on the water, and by no means the lion among lambs, in a contest with larger wooden vessels, which Mr. Cobden imagines it to be. With plenty of sea-room they would run it down before it could do much mischief. For harbour defence—if taking up positions upon the shoals—such vessels would certainly be very efficient. But sea-going properties and powers, including in the latter great steam resources both in engines and coals, appear to me to be paramount qualities for a roaming light-craft cruiser, and that a great deal of what is now considered indispensable for defence, whether it be in iron or in wood, might in this case be wisely sacrificed to obtain them. At any rate, I would only place armour upon a semicircular bulwark across such a vessel, and at some distance from the bow, taking care to fight her stem on, in which position, nevertheless, the whole of her armanent (two guns) would be employed.

I speak with some confidence of the impossibility of combining the full sea-going properties and powers, which a steam cruiser of the class of sloops and corvettes ought to have, with the iron and wooden defence of the "Warrior," in like proportional extent of surface; for having last year sent you two preliminary letters, describing in general terms the form and mode of construction of a vessel by which I hoped to approximate at least towards a solution of this problem, I subsequently set to work upon the drudgery of calculation for all the details, the result of which was, that wishing to limit my displacement to 2,000 tons, and to facilitate speed by fixing the proportion of breadth to length in the ratio of 1 to 9 (30 ft. wide 270 ft. long), I found I could not impart what I thought sufficient stability to my ship, by reason of the immense top weight of the armour, armament, &c. Notwithstanding many variations, the centre of gravity would persist in appearing too much above the line of floatation to please me, and the metacentre would obstinately come below the centre, instead of above it. This unstable equilibrium, although partially in the abstract—inasmuch as it depended only on the hull armour and armament, apart from any counterpoise in the weight and stowage of ballast, engines, and coals—did not appear to me to be the right thing, however slightingly some marine architects would perhaps have considered it. The great evil of the present day in our ships of war, and especially in our iron-clads, is their rolling—the "Warrior" lately rolling 30 degrees, so it is reported—and though this question belongs to dynamics, and that of equilibrium to statics, yet there is a connection between them, and I was desirous, above all things, of giving my guns a steady platform. By the bye, Mr. Scott Russell is reported to have said in one of his lectures, that the centre of gravity of the "Warrior" is 6 ft. above the water-line. Can this be correct? How much higher, then, can the metacentre be? Well, in addition to this awkward state of affairs, I found I could not put into the hold of my vessel that amount in weight (though enough to restore a certain degree of stability) of engines and coals which I deemed requisite for sea-going efficiency, although I would have been satisfied with a probable speed of 14 knots an hour. And yet my project rested upon the principle that only one-third (90 ft.) of the vessel's length should appear above water and want armouring, along with a portion of this part of the hull, requiring protection below the water-line; the remaining portion, amounting to more than three-fourths of the displacement, being supposed to be sufficiently defended from shot by being submerged. How such a vessel, extending 90 ft. under water, beyond the stem, and the same beyond the stern, would behave in heavy seas, I cannot pretend to say. However, such was my principle, and, although involving little surface to cover with armour, I found it to be impossible to combine the requisite speed with invulnerability on such a moderate scale of displacement. And here I would remark, that a light craft, carrying two guns amidships and as heavy pieces of ordnance as you like, is just that sort of vessel which requires speed the most, in order to render it efficient as a war ship, whether for offence or defence, or for running away. Speed is power: and here, in my opinion, it is the supreme consideration, and therefore I have now given up the idea of making such a vessel invulnerable; and to this conclusion, I think, the Admiralty also will come in due time. In the mean while, it will be very proper to experiment with Mr. Reed's ships, but not to rush headlong into a great expenditure in that direction. On this point "Civilian" and myself will agree. But the public must not be disappointed if Mr. Reed's ships do not steam more than 7 or 8 knots an hour, for that is about the speed, I believe, which, at the utmost, he has promised. That he will be able to do so much, and carry sufficient coals to keep it up for a few days, is a great feat, and a very clever thing.

I am, &c.,

BENJN. CHEVERTON.

PATENT LAW REFORM.

SIR,—I beg to resume the subject of "Patent Law Reform" in your journal. Allusion to some matters of machinery in the prosecution of a patent, may, I think, be useful to your readers. The present rules which regulate the term and extension of a patent, appear to me to be reasonably and fairly subject to any suggestions your correspondents may have to make. It is not, I think, likely, that either the one or the other will be extended. There is clearly an indisposition to extend the monopoly of patentees, which I think it desirable to impress on your readers.

The "provisional specification" is at present, as is generally known, of a very doubtful character. I need scarcely say that the value of a patent is dependent on its sufficiency. The Government is generally prepared in haste to satisfy what I may call the "eagerness" of our inventor. Its terms are intentionally *elastic* and *pliable*, and no doubt to some extent these are necessary and indispensable incidents. Human actions in every department of life are, and can only be, mere approximations to perfection, which alone is but a tribute of certainty. It seems to me as the result of my own observation and experience, that it will be but to dispense with what are known as "claims." If this be so, the "provisional specification" should simply consist of a representation of the invention, the whole of which, it might be understood, is claimed as a *combination*. This, I suggest, for the consideration of your readers.

Now, Sir, as to the "complete specification;" this, as we know, is intended to disclose the details of the invention *in extenso*. This document ought to be so clear and explicit, that an ordinary machinist could, with the aid of the drawings, make a like machine. Why should not the original specification be sufficient? It really seems to me that the document in question might advantageously be sufficient for all purposes. The adoption of one specification would at least relcive the perplexing questions which are constantly arising under the the present system. Allow me to urge the consideration of your readers to this subject, as one which involves no small expenses, both in its *preparation* and *consequences*. The "claiming clauses" which are commonly introduced into the document, almost invariably fail to accomplish their object. More than this, it is a well-understood principle by lawyers, that the "second specification" cannot enlarge the first, so that the latter has to be read and expended by the former. This is a stringent rule of construction, since inventors commonly endeavour to vary or improve the mechanism on the results of subsequent observation or discovery. What are your readers' views on this question.

Let me, in conclusion, add one *suggestion* with the specification, and this I can make without any supposition of personal interest. It is desirable that the specification in all cases should be prepared or settled by professional machinists, and that a liberal remuneration should be given. These documents surely depend, not upon their *length* or *complexity*, but upon their *accuracy* and *simplicity*. I ventured to press this caution on your readers attention.

I am, &c.,

J. CULVERHOUSE.

3, Compton-street, Ballspond,
Feb. 23, 1863.

WEAKNESS OF CAST-IRON.

SIR,—A very interesting illustration of the weakness of cast-iron, when subject to a sudden strain, is now attracting public attention opposite the Horse Guards. A cast-iron girder, to form the outer girder of the bridge for the new line of railway at Balham, was being transported to that place from the Great Western Railway. It was about 36 ft. long, and 3 ft. deep, with top and bottom flanges 6 in. wide. The iron about 1¼ in. thick.

It was laid upon the "trolly," or truck, upon its side, with its hinder end near the ground, and its front end projecting over the front of the truck. The two bearings on the truck being about 12 ft. from each end, and 12 ft. apart. On arriving at the place above mentioned, a sudden jolt on the stones caused the overhanging piece, weighing rather more than a ton, to snap off as though it had been glass. By the merest accident the girder lay somewhat obliquely, and the piece fell just clear of the horses.

N. B.

Whitehall.

[Advertisement.]

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I have been a subscriber to your MAGAZINE from its commencement, August, 1823, and you have published many letters from me on various subjects, for which I thank you. I have, in this instance, to ask a favour by your inserting the following letter, which has been refused as an advertisement in the *Engineer* newspaper. I have been frequently attacked by that journal, and they have as fre-

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* Literary gentlemen are too often apt to think that they are competent to write on any subject. A ludicrous instance, however, of their occasional incapacity occurred the other day in "our own correspondent's" communication to his daily paper, in which, lamenting the continued employment of wood and hemp instead of iron in Devonport dockyard, he observed that, "The suspension of this stupendous and superfluous rope-making would at least be felt beneficially in the *linen* trade, because just now the demand for *linen* is extremely active." No doubt this gentleman could have written equally well for our entertainment, if not for our instruction, about armour plates and shipbuilding.

quently refused to insert my replies, thus leaving the public to believe that what they had stated were facts.

Yours respectfully,
J. Hopkinson.

[Advertisement.]

To the Editor of the "Engineer."

Sir,—I beg to inform you that the fourth edition of my treatise, "The Steam Engine Explained by the Use of the Indicator," is just published, and the price is 2s. 6d.; it contains practical explanations on valve setting, compounding, and expansion, together with rules and tables for the management of the steam-engine, boiler, &c. I anticipate the same onslaught upon this edition as you passed upon my third edition, and write to prepare your readers for the attack. It has, as you previously remarked, again "*extended itself*," having now upwards of 400 pages, and illustrated by 100 wood-cuts and engravings. Should you again criticize, I hope you will give me an Englishman's right, by inserting my reply, which was refused me on the last occasion.

Apparently, my third edition has been of great value to you in answering some of your correspondents, and I trust this edition may be of further use by supplying you with practical facts and examples derived from experience, not in the office, but in company with the steam-engine.

I remain, yours respectfully,
J. Hopkinson, Engineer.
Britannia Works, Huddersfield.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2188, 2226, 2240.
Boilers and Furnaces, 2213, 2251.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2181, 2185, 2202, 2223, 2230, 2231, 2242, 2243.
Ships and Boats, including their fittings, 2190, 2205, 2208, 2214, 2215, 2216, 2221.
Cultivation of the Soil, including agricultural implements and machines, 2218.
Food and Beverages, including apparatus for preparing food for men and animals, 2194, 2199, 2217, 2219, 2220.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2189, 2192, 2197, 2198, 2200, 2203, 2204, 2211, 2227, 2229, 2237, 2241, 2247.
Buildings and Building Materials—*none*.
Lighting, Heating, and Ventilating, 2174, 2178, 2182, 2206, 2212, 2234.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2173, 2184, 2187, 2195, 2207, 2222, 2232, 2236, 2245, 2250.
Metals, including apparatus for their manufacture, 2175, 2191, 2253, 2254.
Chemistry and Photography—*none*.
Electrical Apparatus, 2238.
Warfare, 2180, 2186, 2210, 2224, 2239.
Letter-Press Printing—*none*.
Miscellaneous, 2172, 2176, 2177, 2179, 2183, 2193, 2196, 2201, 2209, 2225, 2228, 2233, 2235, 2244, 2246, 2249, 2252, 2255.

2172. J. Ransom and E. Ransom. *Improvements in mounting millstones.* Dated July 31, 1862.

This consists in a method of connecting millstones with the impelling shaft or spindle, so as readily and conveniently to adjust and preserve the parallelism of the stones. For this purpose the centre of the mace which impels the runner is mortised to fit on the head of the spindle; from this central mace proceed three or more equi-distant arms extending to the outside of the stone, eye, or other sufficient length. A flange rises on each side of these arms, forming a groove to receive the arms of the centre iron. Screws pass through these flanges, their points pressing against the arms of the centre iron, and propelling the stone. In the under side of the centre iron, which carries the runner, a hollow is sunk to receive the the top of the spindle on which it rests. The arms of the centre iron extend beyond the eye into the body of the stone, in which they are firmly fixed. A screw passes perpendicularly through each arm, and its extremity rests on the corresponding arm of the mace. By means of these screws (or by wedges) the parallelism of the runner and bed stone can be adjusted and preserved. *Patent completed.*

2173. C. Bedells. *Improvements in the manufacture of braces.* Dated July 31, 1862.

This invention consists in the manufacture of braces from loop-formed fabrics, such as are produced in knitting and warp machinery. The braces are formed of two thicknesses of the material cemented together. *Patent completed.*

2174. G. T. Bousfield. *Improvements in the manufacture of fluids suitable for burning in lamps, and for other uses.* (A communication.) Dated July 31, 1862.

The patentee claims the compound produced by the combination of the mineral oils with fusel oil, the said compound constituting a new manufacture. He also claims the compound produced by the combination of naptha with alcohol and fusel oil, the said compound constituting a new manufacture. He also claims the heavy liquid obtained by treating the combination of petroleum (or kerosine) and fusel oil with alcohol, the said heavy liquid constituting a new manufacture. *Patent completed.*

2175. A. V. Newton. *Improved machinery for planing metal.* (A communication.) Dated July 31, 1862.

This consists in furnishing the table of the machine with a rack of an ordinary construction, and in operating this rack by a worm or screw, which enables the driving shaft to cross the bed diagonally, passing out in a position near enough to the upright which carries the slide rest and cutting tool, to enable the driving belt to be within reach of the operator. And it also consists in a peculiar mode of transmitting and arresting motion by a ratchet, which must be the driver, and a double pawl attached to the object to be driven, so that while retained in gear with the ratchet motion will be imparted to the object to be driven, until, by the interposition of a suitable stop, the continuous motion of the ratchet will lift the pawl out of gear. It consists also in providing this pawl with a suitable projection, having upon it a friction, which shall always be in contact with the driver, so that when the motion of the driver is reversed the friction pad will reverse the position of the pawl, and cause it to present its other end to the ratchet, which is thus enabled to move it in the opposite direction, until the pawl is again lifted out of gear by the interposition of a suitable stop, as before; also in controlling the position of the two belts which impart motion to the machine in opposite directions by the segment of an internal and external wheel, working about a common centre, and having one tooth on each gearing, into a corresponding tooth on each belt shifter; so that a full movement of the segment in either direction will operate the belt shifters, but not at the same time, one being arranged to complete its movement before the other commences, and upon reversing the motion of the segments the movement of the shifters will take place as before, but in the reverse order, that is, the shifter which completed its movement last will commence, and complete its movements first, whenever the segments are moved in the opposite direction. *Patent completed.*

2176. W. E. Newton. *Improvements in lubricating compounds.* (A communication.) Dated July 31, 1862.

This consists in the production of a lubricating compound or fluid composed of coal oil obtained in a natural state, or simply by artificial distillation, combined with caoutchouc, and with or without the addition of water. *Patent completed.*

2177. J. List. *An improved means for obtaining distances and heights, and distances between distant objects, without computation.* Dated August 1, 1862.

This consists of, 1, an instrument made of wood and brass, with hinges to fold into a suitable size for carrying in the pocket. When in use it is opened out in the form of a square; it is provided with two small foresights, and a back sight hinged to a moveable slide; a small stand with a socket connects it to a rifle when piled, or to a common tripod. For taking the quantity of an angle a line of tangent divisions (the radius being 20 in.) is marked on the sliding part, and also above it on the fixed part; on the other or lower part there are proportional divisions, with numbers to indicate at sight the distance of an object. There is also a table of figures for giving the height or distance between two objects at a distance, according to the number of degrees and minutes subtended in the observations. An extended scale is also provided to show more accurately the long distances; 2, The instrument in the form of a drawing board, or table top, is applicable for ships of war, and is made to ship and tranship for putting away when not required; it is provided with bearings for a telescope, in addition to the other sights, so that the common sights and telescope can be used at pleasure. *Patent abandoned.*

2178. J. Sinclair. *Improved arrangements for ventilating, and in part applicable for fumigating.* Dated August 1, 1862.

A modification of these improved arrangements, suitable for a dwelling house, for example, comprises in the first place apparatus for admitting fresh air from without into the hall or lobby. Provision for this may be made by an opening in any part of the wall; it is, however, most convenient to contrive this at the top of the door. For this purpose a recess may be cut or formed in the lintel to receive an air duct of a rectangular or other convenient form; or the duct may project downwards from the lintel, and a recess be cut out of the top edge of the door to fit it; or, again, it may be fixed to the top of the door. The outer end of the air duct is open for the air to enter, and at the inner end it communicates with a shallow vertical box, the side or sides of which are perforated to cause the air to enter in a diffused condition, and without perceptible draught. Similar apparatus for the ingress of air is provided at the doors of the various rooms communicating with the hall or lobby. The modification of the improved arrangements suitable for ventilating potato mounds, corn ricks, and the like, comprises apparatus made, by preference, in sections or lengths, which can be combined to suit various sizes of mounds or ricks. A section of the apparatus consists of a rectangular box of convenient length, divided by a partition into two ducts. The bottom duct is for the egress of vapour or vitiated air, which enters it by perforations in the bottom and sides, and leaves it at either end. The upper duct is for the inlet of fresh air, which enters at either end, and is diffused amongst the vegetables or grain through perforations in the top and sides. *Patent abandoned.*

2179. D. T. Lee. *Improvements in ornamenting surfaces of wood and of papier mache.* Dated August 1, 1862.

In ornamenting a surface of wood, according to this invention, the inventor takes a piece of veneer, and by means of the process called saw piercing or fret cutting, he cuts or pierces in the said veneer all those parts of the ornament which on the surface to be ornamented are to be sunken or depressed. He attaches the pierced veneer by means of glue to the surface to be ornamented, and afterwards polishes the surface of the veneer. There is thus produced an ornament on the surface of the wood which has the appearance of a carving on a flat or plain surface. The surface to which the pierced veneer is glued or attached may be matted or wrought before or after the veneer is affixed to it, so as thereby to produce a closer resemblance to carving from the flat. In ornamenting surfaces of papier mache, he proceeds in the manner described with reference to wood, excepting that he attaches pierced veneers of papier mache to the papier mache to be ornamented, and finishes the ornamental surface by the processes ordinarily employed for finishing surfaces of papier mache. *Patent abandoned.*

2180. G. Haseltine. *Improvements in apparatus for drying grain, gunpowder, &c.* (A communication.) Dated August 1, 1862.

This apparatus consists of a hollow cylinder, or its equivalent, provided with self-opening and closing valves, or their equivalents, for the transmission of air. It is hung upon a horizontal shaft, and is rotated by the application of any convenient power for the purpose. The patentee claims the rotating cylinder, or its equivalent receptacle, for containing and keeping in motion the material acted on, when the same is provided with a valve or valves, or an equivalent arrangement, for the transmission of air for ventilating, and for the passage of the vapour evolved, substantially as described. *Patent completed.*

2181. G. A. Biddell. *Improvements in railway crossings.* Dated August 1, 1862.

These improvements have reference to the construction and manufacture of chilled cast iron railway crossings, for which letters patent were granted to the present patentee, bearing date 19th September, 1855 (No. 2113). The patentee claims preventing the chilling action taking place quite up to the extreme ends or point of the upper wearing surface of the crossings, so as to form the parts, which have been found liable to chip and break off, less brittle, more tough, and much less liable to chip or break than when chilled at those parts as heretofore. *Patent completed.*

2182. J. C. Onions. *Improvements in portable forges.* Dated August 1, 1862.

This invention consists in the employment of a fan for creating the blast, and in the arrangement of the parts hereafter described. The patentee places the fan under the hearth, and at the back end of the forge, and leads the blast up into the fuel through a bent tuyere or pipe, in which the upper part of the fan case is made to terminate. He places the chest or box for holding tools within the frame of the forge, and below the hearth. He gives motion to the fan by belts passed over pulleys driven by a crank handle, or by toothed gear. *Patent completed.*

2183. R. and D. Nurse. *An improved annealing pot.* Dated August 1, 1862.

This invention consists in employing wrought-iron instead of cast-iron in the manufacture of annealing pots, and also in making the pot double—that is to say, as two cases, one fitting into the other. By these means the metal will expand and contract without sustaining injury, and the air will be effectually excluded from the plates therein. *Patent completed.*

2184. J. E. Marsh. *Improvements in the construction of metal rivets used in joining or securing together parts of boots, shoes, and other articles of leather, and also in machinery for making such rivets.* Dated August 1, 1862.

In carrying out this invention, the patentee makes the points of the rivets flat, with two sides only, or what are termed chisel pointed, or as nearly approaching this form as possible. Thus made, the point has sufficient strength to allow of its being clenched. The improvements in machinery for making these rivets consist in the alteration of the cutters, which require to be sunk to the form necessary to produce the flat point. *Patent completed.*

2185. C. H. Plevens and H. Rider. *Improvements in the construction of colliery waggons, tubs, or corves, and in apparatus for tipping or discharging the same.* Dated August 1, 1862.

This invention consists in the employment of an end door, hung and fastened in a peculiar manner, which allows the door, by a self-acting arrangement, to be raised and released from its lower fastenings, the pressure of the coal against the door causing it to swing outwards, and the door being at the same time raised, as above stated, the free discharge of even the largest coal is obtained. *Patent completed.*

2186. W. E. Newton. *Improvements in projectiles for ordnance and small arms, and in the wads or sabots to be used therewith.* (A communication.) Dated August 1, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2187. T. G. Webb. *Improvements in the manufacture of flint glass.* Dated August 1, 1862.

This invention has for its object a reduction of the expense of manufacturing flint glass, with which view the patentee uses sulphate or muriate of potash, in place of or in combination with the carbonate commonly employed. *Patent completed.*

2188. T. Onion. *Improvements in rotary steam-engines, and in propellers adapted to propelling vessels in water.* Dated August 2, 1862.

In the specification of letters patent granted to the present patentee, dated the 21st day of January, 1847 (No. 11,539), he described a rotary engine with a revolving piston in a stationary case, having two rings, or vanes, upon which the steam alternately acted to produce rotary motion to the main shaft, upon which the revolving piston was fixed, there being a single abutment with an inlet or outlet passage on each side thereof. But, by such arrangement, it has been found that the pressure exerted by the steam on the parts as they rotate is unequal, which, when applying such engine to the purpose of propelling, is especially prejudicial, and an object of the first part of the present improvements is to remedy this evil. For this purpose, he applies two abutments and two inlet and outlet passages for the steam on opposite sides of the case, and he employs four sliding vanes, or wings, to the revolving piston, by which the effect of the pressure of the steam, as well as of the exhaust, will be always acting equally on opposite sides of the shaft. He also gives additional support to the wings, or vanes, to lessen friction on their surfaces as they move to and from their axis, by causing them to slide in flanges, or projections, at the ends of the rotating piston in the case. As screw propellers are at present arranged, the water is acted upon and thrown off therefrom when they are in motion at an angle to the line of the shaft, and the direction of motion of the vessel, which is found materially to interfere with the correct action of the steering apparatus. To remedy this evil, according to the second part of this invention, he applies a flange, or flanges, standing out from the face of such propellers, to cause the water, in their rotation, to be thrown off them in a line corresponding with that of the propeller shaft, or directly opposite to the direction of motion of the vessel, by which the rudder will have free action on the water, in either direction, for the proper steering of the vessel, whilst a considerable advantage will also be gained in counteracting the slip through the water. *Patent completed.*

2189. J. Briggs. *Improvements in the manufacture of belts, webs, braids, tapes, laces, and other similar articles produced by weaving, plaiting, or twisting.* Dated August 2, 1862.

This invention relates to such articles as belts, webs, braids, laces, tapes, bindings, and other similar articles known in the trade as small wares, and consists in manufacturing such articles with a figured surface, the designs or patterns to be obtained by printing either one or both sides with engraved cylinders, in contra-distinction to producing such patterns by means of jacquard weaving and by block printing. *Patent completed.*

2190. J. Gray. *Improved means or arrangements for cleaning ships' bottoms, and for preventing the fouling thereof.* Dated August 2, 1862.

This invention is founded on the well-known fact that, when the asteroida, mollusca, and cirrhopæda (which are the kinds of shell fish usually found upon ships' bottoms), at first attach themselves to the ship's bottom, they are in a soft gelatinous state, and can be easily scraped or brushed off, whereas if they are allowed to remain a little while they become encased in hard shells, and so firmly fixed as to require very considerable force to remove them. Similarly seaweeds and other adhering matters are much more slightly fixed and more easily removable when only freshly attached than afterwards. This said invention consists in taking advantage of these circumstances by cleaning the ship's bottom continuously, or at short intervals, and in providing conveniently available means for affixing such continuous or intermittent cleaning, either whilst the ship is sailing, or whilst it is in port. *Patent completed.*

2191. E. B. Wilson and M. Picard. *Improvements in the manufacture of iron and steel.* Dated August 2, 1862.

The object of this invention is to run molten iron or steel directly from a converting vessel, mounted on trunnions (or otherwise capable of a rotating motion) in which it has been produced, into moulds, or into receivers placed over the moulds. The form of the receivers is such as will admit of the metal entering the moulds under a very slight pressure, and is so arranged as to facilitate the removal of the scoria floating on the surface of the metal. *Patent abandoned.*

2192. C. Warne. *Improvements in the manufacture of linen drabbett.* Dated August 2, 1862.

This invention consists in manufacturing drabbett of flax warp and flax weft. The advantage of using this flax warp and flax weft combined, instead of flax and cotton, is that it is much more durable and stronger. This material is dyed drab, olive, slate, or other suitable colours. *Patent abandoned.*

2193. G. Coles, J. A. Jaques, and J. A. Fanshawe. *Improvements in the manufacture of grinding and polishing tools and surfaces.* Dated August 2, 1862.

This invention relates, in the first place, to a mode of producing such articles by a combination of pulverized gritty or cutting ingredients, with a preparation of oxydized or other oil and sulphur, with or without the addition of resinous, gummy, mucilaginous, or albuminous matters. In carrying out this part of the invention, the patentees use either emery, pulverized glass, fine granulated iron, or fine iron or steel filings or borings, or other hard cutting substances reduced to a finely-divided state, and they mix these substances in combination with any suitable oil and resinous, bituminous, or gummy matter, or mucilaginous or albuminous matters (in some cases with the addition of sulphur or sulphurets), taking care that all the ingredients be well mixed or incoporated, so that the whole mass may be brought as near as possible to a homogeneous state. Secondly, in combining fine steel or other hard wire with any suitable plastic material, such as that above mentioned, so as to produce a cutting surface like a file or rasp. *Patent completed.*

2194. A. and E. M. Denny. *Improvements in the manufacture of bacon.* Dated August 4, 1862.

This invention relates to the mode of keeping the pickling liquor used for curing bacon at an even temperature, without emptying the vessel in which it is contained, and thus avoiding exposure of the meat or dead carcasses of the pigs to atmospheric influences; also the bacon is more evenly cured than by the process now adopted, by which it is subjected to many variations of temperature. The invention consists in drawing off the liquor at or near the bottom of the vessel containing the meat, and passing it through layers of ice, or ice and salt, or, if preferred, through a coil of pipes placed in a refrigerator or in ice. The liquor being thus reduced in temperature, it is run on the top of the vessel, thus keeping up a circulating current of cool pickle through the pickling vessel. This current is continued until the proper temperature is obtained. The taking off and running on of the liquor may be done by pumps or other suitable contrivance. *Patent completed.*

2195. S. Simon. *An improvement in ornamenting ladies' and children's slippers.* Dated August 5, 1862.

This invention consists in cutting, stamping, or otherwise perforating any ornamental designs out of the fronts of the uppers of ladies' and children's slippers, and fixing a piece of different-coloured leather at the back of the same, so as to show through the perforations. *Patent abandoned.*

2196. J. Thomas. *An improved self-adjusting screw wrench.* Dated August 5, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2197. J. Higgin. *An improved substitute for cow-dung, used in printing and dyeing textile fabrics or yarns.* Dated August 5, 1862.

The patentee has discovered that certain alkaline salts, namely, the tungstates and molybdates, may be used for neutralizing acid phosphates and arseniates without any insoluble compound being precipitated, and, consequently, without any loss or waste of phosphoric or arsenic acid. The compound salts thus produced forms a convenient substitute for cow-dung in the dunging process, without the disadvantages found inseparable from the old phosphate of lime and soda. *Patent completed.*

2198. J. Townsend. *Improvements in damping cotton and other fibrous materials and fabrics, in preserving the same from mildew, and in preserving size or stiffening from decomposition.* Dated August 5, 1862,

This invention has for its object to prevent the inconvenience occurring when cotton or other fibrous materials or fabrics are damped or stiffened in the ordinary way. And the said invention consists in applying chloride of magnesium, chloride of calcium, or a mixture of both, to the fibrous material, either prior or subsequently to its being woven. *Patent completed.*

2199. W. Clark. *Improvements in the purification of water, and in apparatus employed therein.* (A communication.) Dated August 5, 1862.

The patentee claims—1, The improved method of ascertaining the proportions of lime necessary for the purification of different calcareous waters, by means of the instrument described, and which the patentee terms a hydro-calcemeter, by which alone this improved purifying process can be rendered generally practicable. 2, The application of this improved instrument, or hydro-calcemeter, for registering the amount of carbonic acid or carbonates, or for measuring the caustic power of different kinds of lime. 3, The application of this improved system of purification for the extraction and utilization of precipitate, either natural or contained in other matters, such as carbonic acid, or sulphate of lime, or they may be reduced to lime and again rendered suitable for the purification of water, or for other purposes, in the manner described. *Patent completed.*

2200. M. J. Roberts. *Improvements in means or apparatus for spinning and preparing wool and other fibrous substances.* Dated August 5, 1862.

The object of these improvements is—1, To obtain a better drag to the thread, or yarn, whilst being wound on to the bobbins in preparing or spinning fibrous substances. For this purpose, whilst the flyer has motion given to it by a band, as is well understood, and the bobbin is capable of being drawn round by the act of winding thereon, such motion to the bobbin is retarded by its friction on a spindle, the lower surface of the bobbin resting on a supporting base carried by the spindle, and by adjustable, weighted, or other pressure, applied to such spindle. Or the bobbin may be fixed upon the spindle, and the spindle retarded, as before mentioned. But, in all cases, the inventor makes the spindle to be driven by the flyer, or the flyer by the spindle, so that one may partake of all the inequalities of motion of the other. The invention relates—2, To the use of a shield, or protector, applied to flyers in spinning and preparing frames, for the purpose of preventing entanglement of the fibres of yarn proceeding from the delivering rollers with those of the yarn upon the bobbin where such yarn is wound on. *Patent abandoned.*

2201. J. R. Nicholl. *Improved means of, and apparatus for, utilizing and disposing of the sewage of towns and villages.* Dated August 5, 1862.

In carrying out this invention, the inventor proposes to employ the natural porosity of the soil—where such is available—for disposing of the fluid portion of the filtration, having previously brought the sewage to the proper condition for filtering rapidly through the soil. He lengthens the sewer, or sewers, which have been, or may be, formed by the addition of two, three, four, or more diverging channels, which, from their extended surface, will cause a sluggish flow of the sewage. Each of these diverging channels he fits with sluice valves, which permit of the discharge, at suitable periods of the sewage, into removable tanks. Before escaping from these tanks, the fluid will have to pass through a filtering sieve, or strainer, and continue its onward course in the sewer; or it may, if need be, be passed through a second and finer strainer. The sewage, flowing very slowly through the tanks, will leave a continually accumulating deposit in them, and, when any one of them is full, its sluice valve is to be closed. A heavy lid, fitting into the tank, or other pressure, may be applied for expressing the remaining fluid from the tank, suitable perforations being made therein for admitting of the discharge of the fluid. The filled tank is now to be removed, and another substituted in its place, to restore the communication between the detached parts of the sewer. *Patent abandoned.*

2202. A. Priestley. *Improvements in arrangements or apparatus applicable to locomotive railway engines and carriages for distributing sand upon the rails to give adhesion to the driving and brake wheels of such engines and carriages.* Dated August 5, 1862.

The object of this invention is, that coarse, wet, stony, or clayey sand may be used (but coarse wet sand in preference), and delivered on to the rails with certainty in a continuous and uniform layer when required. The invention consists in the use of agitators and screws or equivalent mechanism, which are placed in a box or hopper containing sand, which agitators and screws receive continous motion when required from the axle of the wheel, or the periphery of the wheel of the engine or carriage to which the apparatus is applied, so that the sand is uniformly delivered when required from the box or hopper, and is conducted down a pipe to the front of the wheels to which adhesion is to be given. *Patent completed.*

2203. W. W. Burdon. *Improvements in reducing wood fibres to pulp.* Dated August 6, 1862.

This invention consists in the use of fixed stones, rasps, or other like reducing agents, and in passing blocks or pieces of wood across the grain or fibre thereof, over and upon such stones or reducing agents. The patentee employs water to assist the reduction of the fibre, and to carry off the pulpy mass. Or he reduces the wood to pulp by rubbing stones upon wood across the grain thereof. In some cases he finds it advantageous to soften the wood by steam, or by boiling in water, or in an alkaline solution. *Patent completed.*

2204. J. C. Richardson. *An improvement or improvements in cleaning cotton waste.* Dated August 6, 1862.

In order to effect the cleaning of the said cotton waste, the inventor first boils it in a strong solution of common soda or caustic soda, or other alkaline solution. He boils the cotton waste in the said solution during six or eight hours. He next steeps the cotton waste in dilute sulphuric acid for six or eight hours. The acid he employs consists of a mixture of one part by volume of commercial oil of vitriol to 30 parts by volume of water. He afterwards washes the cotton waste in water, and again boils it for about six hours in a dilute solution of soda, or in other alkaline solution. He finally washes the cotton waste in water, and then dries it in a stove, or allows it to dry by the spontaneous evaporation of the water remaining in it after the greater part of the water has been pressed or squeezed out of it. *Patent abandoned.*

2205. M. C. Sinibaldi. *Improvements in the manufacture of chains, and in the apparatus employed therein.* Dated August 6, 1862.

For the purposes of this invention the links are cast of suitable metal, and the succeeding links are, in the act of casting, caused to link one within the other. A series of metal moulds are employed, and they are formed, arranged, and connected together to produce alternately the horizontal and vertical links. Each mould is, by preference, formed to have a single link cast therein, and the series of moulds are placed or connected together in such manner that the melted metal run into one mould does not enter or mix with the metal which is run into the other mould or moulds used therewith; on the contrary, the succeeding links of a chain, whether cast in succession or simultaneously in a series of moulds, are separate castings, and are, by the act of casting, linked one in another. In this manner may any desired number of moulds be used, and each have a link cast therein, and, by reason of the forms of the moulds, and their being used together, the succeeding links will, when cast, be linked into each other. *Patent abandoned.*

2206. W. G. Valentin and F. Levick. *Improvements in the generation of combustible gases for lighting and heating purposes, and in the mode of applying such gases to the manufacture of iron, glass, and other processes in the arts where great heat is required.* Dated August 6, 1862.

This invention consists in an improved mode of obtaining combustible gases from the decomposition of water and carbonaceous matters. The generation of hydrogen gas by the decomposition of water into its two elements, hydrogen and oxygen, has long been known, but great difficulty has been hitherto experienced in effecting the desired object in an economical and regular manner, and especially in obtaining hydrogen sufficiently carburetted to admit of its being usefully employed also for lighting purposes. This invention consists in passing steam (either common or superheated steam, but by preference the latter) through a mass of incandescent fuel, such as coal, coke, or charcoal, by which means the steam will be decomposed, and the hydrogen will be set free, and a part thereof will combine with a small portion of carbon, thereby producing carburetted hydrogen, while the oxygen will combine with another portion of the carbon and produce carbonic oxide, together with smaller or larger quantities of carbonic acid, according to the manner in which the decomposition of the steam is carried out. This gaseous mixture or mixed gases will be found to possess a high degree of heating power when burnt with air, and may be employed for various heating purposes, such as melting, refining, puddling, and heating iron. As the passage of steam through incandescent carbon will greatly reduce its temperature, and will, in fact, finally extinguish or stop the combustion whenever the point is reached where the temperature of the incandescent carbon falls below the temperature at which the decomposition of steam by carbon into carbonic oxide and hydrogen can take place, it is necessary to keep up the temperature by heating the retorts from the outside. *Patent completed.*

2207. F. Nauheim. *An improvement in the ornamenting of boots, shoes, and goloshes,* Dated August 6, 1862.

This invention relates to the ornamenting of the uppers or parts of the uppers of dress boots and shoes, and also goloshes when formed of enamelled leather. The ornament which the inventor proposes to adopt may consist of any appropriate device, the effect being obtained by removing the gloss from the leather at the part where the ornament occurs, the glossy surface remaining to form the back ground. This dulling of the surface may be effected in various ways. *Patent abandoned.*

2208. J. H. Johnson. *Improvements in the construction of armour plates for ships and forts, and applicable to other like purposes.* (A communication.) Dated August 6, 1862.

This invention consists in making armour plates of several laminæ, but in lieu of connecting the whole of such plates together by bolts passing through the entire series, it is proposed to couple only the contiguous ones; thus—if four plates or laminæ be employed, No. 1 will be bolted, rivetted, or otherwise secured to No. 3, which, in its turn, is similarly secured to No. 3, this plate being secured to No. 4 plate, and so on throughout any desired number of plates. *Patent completed.*

2209. M. A. F. Mennons. *An improved self-inking hand-stamp.* (A communication.) Dated August 7, 1862.

This invention consists in a self-inking stamp combining the stamp or die, and the inking pad. The die turns on itself in raising or descending the interior of the apparatus, and thus presents its face alternately to the inking pad, and to the article which is to receive the impression. The inking pad and ink reservoir are placed in the upper part of the interior of the apparatus, but so that the hand of operator is not in immediate contact with the part in which they are contained. The invention cannot be fully described without reference to the drawings. *Patent completed.*

2210. C. Culling. *Improvements in fire-arms.* Dated August 7, 1862.

To render fire-arms less liable to be discharged by accident, apparatus is, according to the invention, applied to a fire-arm in such manner as to hold or retain the hammer or trigger, or parts interposed between them, so that the fire-arm shall not be discharged till the cheek of the person using the fire-arm is pressed on to the stock in the act of looking along the barrel or barrels in taking aim. With this object a cheek rest or cushion is applied to that part of a stock of a fire-arm against which the cheek of the person when aiming is pressed; the rest or cushion is constantly pressed outwards by the action of a spring, and is in connection with a bolt, catch, or detent, which acts on and retains the hammer or trigger, or other parts of the lock, from movement, until the rest or cushion is depressed by the cheek pressing upon it, and then the motion of the rest or cushion is communicated to the bolt, catch, or detent, which moves so as to leave the lock free to act. The rest or cushion is fixed to a rod or to the end of a lever which passes into the interior of the stock, and such rod or lever is connected with the bolt, catch, or detent, by suitable connecting rods or parts. Upon the butt-plate or other parts of the work is, or are fixed, one or more bolts, balls, or catches, so that in a loading position the action is made void until brought into a horizontal aiming position, when the bolt, ball, or catch, will fall and allow the gun to be discharged by the pressure from the shoulder, and pulling the trigger. When applied to rifles, the cheek rest or cushion may be made adjustable, so as to be easily raised and adapted to the height of the sight, according to the range which may be required; and in this case the rest is made of wood or metal connected by a steel or metal slide to the raising sight on the barrels, so that, when shooting at a short distance, the rest is let in flush with the stock; the sight is also flat upon the barrel. By raising the sight for any distance, the action causes the rest to rise in the same proportion from the stock, so that the cheek rests upon it as upon the stock shooting at short distances. *Patent abandoned.*

2211. A. Thiriez. *A new machine for glossing and glazing all thready fabrics.* Dated August 7, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2212. F. H. M. O. D. O. de Finis de Lacombe. *Improvements in the means of lighting towns.* Dated August 7, 1862.

The patentee claims making atmospheric air subservient as a means for lighting towns or other localities, or the dwellings thereof, by causing the said air to pass through or come in contact with any suitable volatile liquid hydro-carbon, so as to become sufficiently impregnated with the volatile parts of the said hydro-carbon for allowing the air thus impregnated to be ignited and burned by suitable burners, provision being made in the mains, pipes, or other fittings, by proper branch pipes or other suitable means, for allowing to convey into the town or other locality, or the dwellings thereof, fresh, pure, or cool air, for ventilating or cooling the same, whereas this air if properly heated may also serve for warming the same. *Patent completed.*

2213. J. H. Johnson. *Improvements in blast furnaces.* (A communication.) Dated August 7, 1862.

This invention relates to the adaptation to blast furnaces of a peculiar arrangement of apparatus or means for collecting and utilizing the otherwise waste gases which ordinarily escape from the mouth or top of the furnace. According to this invention, a circular or other shaped metal hopper or casing is placed inside the throat of the furnace, and extends a short distance down the same, having an annular space or chamber all round between the outer side of the hopper and the inner side of the throat of the furnace. The gases pass into this annular chamber, and are conducted therefrom to any locality where they are to be used, by suitable conduits or passages opening directly into the annular chamber above referred to. The hopper is connected in any convenient way to a cast-iron plate forming the crown of the furnace, such plate having an annular water-gutter constructed thereon for the purpose of forming a hydraulic joint for the reception of a lip or edge of a dome-shaped metal cover, which entirely closes the mouth of the furnace, but is so formed and disposed as to leave an annular opening between the top edge or lip of the hopper and the inner side or wall of the gutter, to allow a portion of the gases to pass freely over the edge of the hopper, and down into the annular chamber first referred to, suitable stops or valves being placed, if desired, in the openings leading to the chamber below, for the purpose of regulating the draught or passage of the gas. By this system the gases are collected equally from all parts of the transverse section of the furnace, one portion passing over the upper lip or edge of the hopper, and then downwards into the annular chamber, and the other portion passing directly upwards into the annular chamber, entering it at the bottom by passing under the lower lip or edge of the hopper. A weighted lever working on a swivel fulcrum may be used for elevating and removing the cover when required. *Patent abandoned.*

2214. R. A. Brooman. *Improvements in ships and vessels, in order to prevent injury from collisions.* (A communication.) Dated August 7, 1862.

This invention consists in placing from the bow to the stern of the ship or vessel (like a belt) a plate or plates of iron, steel, or other similar material, about 10 in. in width, more or less, and about 5 in. in depth or thickness, more or less, at the centre of each plate. Where the ship or vessel is large, and the main or upper deck is high above the water, the inventor applies another belt or set of plates of iron or steel at the deck next below the main or upper deck. *Patent completed.*

2215. R. A. Brooman. *Improvements in covering ships and vessels built of wood, or iron ships with a backing of wood, before placing iron, steel, or other armour plates on such ships and vessels.* (A communication.) Dated August 7, 1862.

This invention consists in placing india-rubber sheets, or gutta-percha sheets, or other similar material or substance, between the iron, steel, or other armour plates and the wood of such vessel. *Patent completed.*

2216. W. Clark. *Improvements in the rig, spars, and sails of ships and other vessels.* (A communication.) Dated August 7, 1862.

The principal objects of this invention are to reduce the cost of the rig, spars, and sails, by a simple construction and arrangement of parts, to obtain increased speed for a vessel by so arranging and applying the sail as to carry a greater area without injuriously straining either the spars or the hull, and to facilitate the working of the sails, and thereby enable a vessel of a given tonnage to be worked by fewer hands. In carrying out the invention, the inventor fits the yards around the mast in such a manner that their axes intersect the axis of the mast, and make one arm of each longer than the other, so that it may carry a longer area of sail on one side than on the other, the portion on one side of or abaft the mast being separate from the portion on the other side or forward of it. The sails and yards thus applied partake in some degree of the character of what are known as square sails, and in some degree the character of what are known as fore and aft sails, and the yards are worked and secured in position by braces in substantially the same manner as the yards and booms of other vessels. He employs in a vessel one, two, or more masts, according to its size, or, as all circumstances considered, may be most desirable; and he employs on each mast the usual or any suitable number of yards, generally preferring to employ as small a number as practicable, as the object is to reduce the height of the masts and sails as much as possible, and compensate for such reduction by an increased width, the arrangement allowing a greater width to be used without those of one mast taking the wind from those of any other; and he proposes generally to dispense with the use of jibs and flying jibs and their booms, and in some cases, with the bowsprit also. The invention cannot be described in detail without reference to the drawings. *Patent completed.*

2217. B. Coombe. *Improvements in apparatus or machinery for cleaning and decorticating wheat and other grain.* Dated August 7, 1862.

In carrying out this invention, the inventor subjects the grain to a severe action between a pair or several pairs of horizontal surfaces or discs, one of each pair of which is stationary, and the other rotating on an axis. These surfaces are roughened or suitably furnished with scrubbers, as may be desired. He disposes one, two, three, or more of the rotating discs on a vertical axis, the one being placed at a suitable distance below the other. The whole is mounted in a suitable framing, and the axis can be raised or lowered at pleasure, so as to approach or separate the scrubbing discs according to the nature of the grain or the treatment it is to be subjected to. The grain to be treated is fed into a hopper in the upper stationary disc, and enters by a hole in the centre thereof. The centrifugal action created by the rotating disc carries the grain towards the periphery, where it escapes, and falls into a cone or hopper of wire-cloth or other perforated material, and is conducted by it to the centre of the next pair of cleaning discs, and so on through the whole series of escapes at the bottom, cleaned as desired. The matters separated from the grain either pass through the perforated material of the hoppers or conducting cones mentioned, or is separated and blown out by a fan, the blast of which takes effect on the scrubbed grain. *Patent abandoned.*

2218. R. W. Ralph. *Certain improvements in, or applicable to reaping machines.* Dated August 7, 1862.

The object of this invention is to obtain an easy and rapid delivery in sheaf for heavy crops, to supersede tipping platforms and other similar appliances which cannot at all times be worked without involving extra labour. This invention is applicable to most of the ordinary reaping machines now in use, without any material alteration of the main framework of such machines. Instead of the platform on which the grain ordinarily falls, the patentee employs a cloth, the front edge of which is attached to or just above the bar carrying the fingers through which the knife works. The near edge of the cloth is attached to a roller, which roller is actuated by a combination of springs and cords, or other suitable mechanical appliances, by which it is advanced to or withdrawn from the finger-bar in a plane at a suitable angle with the ground. As the roller advances, the cloth is wound round it by the action of a coiled spring contained within the roller, causing the roller to revolve. The roller is thus drawn forward until it comes close up to the finger-bar, when the cut corn falls to the ground. The roller is then drawn back either by an attendant pulling a cord wound round another roller in rear of the apparatus, or by the driver putting in gear with the main travelling wheel a friction wheel, to which the cord from its rear roller may be attached. *Patent completed.*

2219. E. Hall. *Improvements in means or apparatus for preparing foreign grain for grinding.* Dated August 8, 1862.

This invention consists in a process of steaming foreign grain, whereby its flinty nature is removed, and the said grain rendered equal to English produce. The means or apparatus consists of a cylinder placed at an incline in suitable framing, with spouts and stoppers for the introduction and delivery of grain, and with pipes and valves, or taps, for the inlet and outlet of steam. Also a rotating winch, or a spindle having a series of arms and wings thereon capable of rotating, is placed within for producing motion or stirring the grain. Or the cylinder may be made to rotate so as to give motion to the grain by having suitable arrangements provided for the inlet and outlet of the steam and grain. *Patent completed.*

2220. J. Siron. *A new beverage used as a cure from several illnesses and distempers.* Dated August 8, 1862.

The liquid forming the subject of this invention will afford almost immediate relief in cases of headache, cramps in the stomach, colic, bruises, cuts, burns, female complaints, diseases of children, such as worms and convulsions, and many other complaints; it will also preserve the air. It is composed of the following parts, culled when at maturity and in possession of all their aroma, both flower and leaf being used, unless one or other be specially indicated—mentha viridis, artemisia foliis primatifivis, hypericum perforatum, lavender spicata, Achillea millefolium, hypericum, juga dæmonium, plantago arenaria, hyssopus officinalis, thymus serpillum thymus vulgaris, tericrium foliis cordatis vindulatis, artemisia absinthium, salvia officinalis, fœniculum, officinale, anethum fœniculum, apium petroselinum, borrago officinalis, lilium candium, flores sambuci, spirea ulmaria, flores tiliæ parvifloræ, flores rosarium centifoliarum, flores citri medicæ, rosmarinus officinalis, verbena officinalis, santonlina, angelica, lytrium salicaria, anthemis pyrethrum. The inventor places the flowers and leaves above enumerated in a glass vase or bottle, mixing them in about equal portions. He then presses them gently down with the hand, and pours upon them as much wine or brandy as will cover them, closes the vase or bottle, and leaves the whole to macerate and steep at an ordinary temperature during thirty days, when he filters, and the liquid is ready for use. *Patent abandoned.*

2221. F. M. Jennings. *A composition for coating ships' bottoms to prevent fouling.* Dated August 8, 1862.

Here the patentee proposes, for coating the bottoms of ships, boats, or buoys, whether of timber, iron, copper, zinc, Muntz's metal, or any kind of sheathing, or coating over any of these, whether or not previously painted, varnished, or otherwise prepared, to use paraffin, Japan wax, bees' wax, the wax of insects, or vegetable waxes, spermaceti or napthaline, or such other hydro-carbons, purified or otherwise, alone or mixed with tallow fats, stearine, or any animal or vegetable fats, common rosin or oil, or any of their constituents. Either of these substances may be used alone, or they may be used when mixed together in any proportions, or one and all of them may be used mixed together with petroleum, pitch, tar, asphaltum, resins, gum resins, rosin, shellac, gutta percha, india-rubber, or other such resinous matters, or any of the oils distilled therefrom. With any or all of the above first-named substances, or their mixtures or combinations with substances afterwards named, he may combine or mix creosote, carbolic acid, or any pyrogenous acid, alcohol, ether, or organic poisonous matter, or any poisonous metal, metallic oxide or salt, or any substance used as paint, either alone or in combination. *Patent completed.*

2222. J. Whipp. *An improved arrangement of apparatus and means for cleaning articles of ornament and jewellery.* Dated August 8, 1862.

This consists in the use of a box, the bottom of which terminates in a wash-leather or other bag, and so arranged that the box may contain the sawdust and bag when not in use. The bag is unfolded and used in combination with the box to polish the articles by shaking them in the sawdust. This combination of box and bag is fitted into a case, with brushes, leather, and rouge, and forms a useful apparatus. *Patent abandoned.*

2223. N. J. Amies. *Certain improvements in the manufacture of bearings, "journals," and "steps," employed in machinery, and for carriage and other axles.* Dated August 8, 1862.

This is designed for the purpose of reducing the friction generally existing between axles or other shafts, and the bearings, journals, or steps in which they revolve, and consists in manufacturing the surfaces of bearings or steps which are subject or exposed to such friction of a composition consisting of animal fibre, plumbago, steatite, caoutchouc or gutta percha, and any resinous gum, animal glue, or size, the proportions being almost immaterial, if the animal fibre be in sufficient excess, the composition being moulded or cut into the regular form. *Patent completed.*

2224. R. A. Brooman. *Improvements in repeating fire-arms.* (A communication.) Dated August 8, 1862.

This consists in the use of a many-chambered slide, made of steel, and set at right angles to the barrel of the gun, and free to slide in a box or carrier. Each chamber carries a separate cartridge, and has nipples and guards to prevent any accidental discharge. There are conical projections or valve seats on the slide which fit into a seat at the rear end of the barrel to secure a gas-tight joint, or the barrel may enter the chamber. For drawing the slide along these is a series of notches formed on the under side thereof, into which spring-catches take, having motion imparted to them by a cam, whereby the chambers are successively brought into a line with the barrel. Motion is given to the slide carrier, spring hammer, and conical spring stop which locks the slide by a set of cams on one shaft and a reciprocating or vibrating lever, and a spring hammer is caused to rise and fall at each rotation of a circular inclined frame. The motions produced by these cams and levers, are—1, The withdrawal of the many-chambered steel slide from and clear of the barrel. 2, Moving it at right angles to the barrel whereby the chambers are made successively to correspond with the barrel. 3, Driving or pushing it up tightly against the barrel, whereby a conical projection is introduced into the rear of the barrel, then withdrawn, and afterwards moved laterally. Several slides may be employed, so that when one is emptied another may be ready for use, and thus a continuous fire maintained. We cannot here quote all the details. *Patent abandoned.*

2225. W. Clark. *Improvements in signalling.* (A communication.) Dated August 8, 1862.

This consists of a universal analytical grammar of signals. The alphabetic transcription of words is replaced by the adoption of signals, and in the complete separation of words from their grammatical elements such as prepositions, adverbs, or other parts of speech. The signal for every word, such as a verb or substantive, and so on, is always the same whatever be the character of the word in the sentence, this character being indicated by a separate signal, which points out the case, gender, number, tense, or mood, and forms the verbs, adjectives, and adverbs, by being added to a substantive. The use of such grammatical signs or signals is thus reduced to a minimum. One single expression is substituted for several synonymous words, the plainest ideas alone being classed under signals. As to the complex ones, they are figured or represented by two or more signals, themselves representing plain ideas. *Patent abandoned.*

2226. E. Humphrys. *Improvements in steam engines.* Dated August 8, 1862.

This relates to that description of steam engines in which two cylinders—a small one, into which the steam first enters, and a large one, in which it is subsequently allowed to expand—are used, and in which the pistons of the cylinders are connected together by a piston-rod passing through the cover, or partition, which separates the small from the large cylinder. The improvements consist in applying a trunk to the large piston, and a suitable connecting rod, as in ordinary trunk engines, to transmit the power from the two pistons to a crank on a shaft or axis. *Patent completed.*

2227. J. Tatham. *Improvements in machinery or apparatus for preparing, spinning, and weaving cotton and other fibrous materials, parts of which improvements are also applicable to other mechanism in which an uniform or variable rotary motion is required.* Dated August 8, 1862.

This refers 1, To drawing rollers of preparing and spinning machinery, the object thereof being the production of a more level yarn, and to enable the patentee to produce the same from fibres of irregular lengths. With this view, he avoids (to a great extent) a drawing action generated at two fixed points, and allows the fibres to be drawn from variable points arising from their own friction or mutual adhesion. To obtain this result he causes the slivers, or other strands, to lap partly around the circumference of one or more of the rollers, such rollers being so arranged as to deliver the material in a regular strand to the front or drawing rollers. This lapping over the surface acts, therefore, as a modified detention, and does not operate upon the fibres by a nipping action, as in the ordinary arrangements, and thus various lengths of fibres are enabled to accommodate themselves to each other, and to enter into combination without a breakage of the longer or a looseness of the shorter. *Patent completed.*

2228. J. Macintosh, *Improvements in obtaining and applying motive power.* Dated August 9. 1862.

This consists in the rapid generation of power by the aid of oxygenous fuel, composed either of coke, coal, and nitrate of soda, or coke and nitrate of potash. In some cases sulphur may be used, or the chloride of potash, and, if desired, put into form with adhesive substances, such as mineral or vegetable pitch, resins, parraffin, gutta percha, caoutchouc, or glue. The prepared fuel is put into closed tubes or furnaces, with valves for the escape of the gaseous products of the combustion, which may be used alone or in combination with steam, air, or other fluids in giving motion to machinery. This oxygenous fuel may be put into ordinary steam boilers, which fuel, when ignited, instantly produces power to give motion to engines, or it may be used for other purposes where power is required as an auxiliary. *Patent abandoned.*

2229. R. Fowler. *An improved manufacture of woven, plaited, knitted, and other fabrics.* Dated August 9, 1862.

This consists in weaving or otherwise plaiting, knitting, or interlacing together threads that are made or composed of a natural gum, as gutta percha, &c., or of a compound of such gum or gums with other gums or ingredients. The gum may be used in the natural or purified state, and it may be dyed, coloured, or otherwise treated to increase its ornamental effect. *Patent abandoned.*

2230. G. Haseltine. *Improvements in carriage wheels.* (A communication.) Dated Aug. 9, 1862.

This relates chiefly to the novel construction of the hub, and peculiar arrangement of the spokes of carriage wheels. The construction of the hub is such that the spokes of the wheel can be arranged in two rows, thus forming a broader base, the spokes being in contact with each other for part of their width, thus filling the entire circle, while at the same time each separate spoke is supported in part, or in whole, upon each side by a metallic mortise. The hub being formed in two parts, and made of metal, enables the inventor, by a screw upon the pipe-box, to compress the spokes edgewise, and thus preserve their position in the wheel, at the same time the desired amount of dish is given to the wheel by the back part of the hub being concave, and the front part convex, where the two parts impinge against the edge of the spokes. By this arrangement the largest possible number of spokes can be introduced, the required amount of dish obtained, and each spoke be supported by a metallic bearing upon either side, and at the inner end upon the pipe. Any shrinking in the spokes causing looseness can be remedied at any time by screwing up the nut that holds the parts together. The wheel is also so constructed that each spoke has a bearing upon the pipe-box. *Patent completed.*

2231. Sir J. S. Lillie. *Improvements in carriage ways and foot ways.* Dated August 9, 1862.

This consists in the construction of carriage ways or foot ways with gutta percha, asphalte, asphalted felt, wood, or other material, or combination of such materials, rendered impervious to water by a solution of caoutchouc, or other solution suitable for that purpose. When such carriage ways are intended for heavy traffic, the patentee causes the same to be studded with metallic bolts, or with bars of iron, or rows of metallic bolts or studs, such rows to be placed transversely or at right angles to the line of traffic, at intervals of not less than 3 in. apart. *Patent completed.*

2232. J. J. H. Gebhardt. *An improved fastening for purses, pocket books, needle books, ladies' companions, instrument cases, and other similar articles.* (A communication.) Dated August 9, 1862.

This fastening is constructed as follows:—In a spring, or in a tongue or plate attached to a spring, is a slot or opening, into which when the fastening is closed a hook, catch, or a recessed indented or notched piece catches or engages. The fastening is opened by applying pressure on the spring by a knob, or equivalent appliance, whereby the part in which is engaged the aforesaid slot or opening is so moved as to liberate the hook, catch, recessed or notched piece, and allow the latter to be drawn therefrom. To close the fastening, the spring is allowed to return to its original position, and the hook or like agent, being introduced into the slot or opening, will engage or catch therein and close the fastening. *Patent completed.*

2233. A. J. Moreau and A. E. Ragon. *Improvements in the mode of, and apparatus for, treating bituminous and carbonaceous substances for the purpose of obtaining the various products, volatile, liquid, and solid, which they contain, and also in the treatment and application of such products.* Dated August 9, 1862.

This invention consists in a mode of treating liquid hydro-carbons whereby they are deprived of their offensive odour, and the lighter and more volatile separated from the heavier portions. The apparatus employed is not described apart from the drawings. *Patent completed.*

2234. A. J. Moreau and A. E. Ragon. *Improvements in the manufacture of gas and coke.* Dated August 9, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2235. T. De la Rue. *Improvements in the manufacture of pigments and writing inks.* Dated August 9, 1862.

The patentee claims the grinding carbon, aniline, waste and other pigments, with glycerine and gum tragacanth, or other gum, as described. Also the use of a solution of saless, and of a solution of gluten or glutinous material in vinegar, in the preparation of inks from pigments as described. *Patent completed.*

2236. T. Bousfield. *Improvements in the manufacture of hat bodies.* (A communication.) Dated August 9, 1862.

This relates to a novel arrangement of apparatus for manufacturing hat bodies, and consists in an inverted perforated cone placed in an exhausted chamber in connection with a picker arrangement for picking and blowing fur for the purpose of facilitating the process of forming hat bodies. *Patent completed.*

2237. H. B. Barlow. *Improvements in machines for weaving, warping, sizing, and dressing.* (A communication.) Dated August 11, 1862.

This consists in giving an oscillating motion to one or more rods by which the warp is divided. This rod is supported on part of the frame of the machine; a lever bears against each end of the rod, and one of these levers is connected by a string or link to an elbow lever with a bell on one arm. When the rod is displaced by any of the warp threads adhering together, the bell is brought into position for being struck by the lay of the loom, or by any other moving part of the machine for weaving, warping, sizing, and dressing to which the improved apparatus is applied. Or, when the rod is displaced, the lever acts on the ordinary stop-rod to move the driving-strap from the fast to the loose pulley. *Patent completed.*

2238. H. Fenton and W. Stubbs. *Improvements in telegraph wires.* Dated August 11, 1862.

This consists in—1, Covering the cones with a thin covering of copper by immersing them in a bath containing a solution of copper, or in any other convenient way, and afterwards applying a coating or coatings of asphalte, black varnish, or of any other like nonconductive substance or substances. *Patent abandoned.*

2239. W. E. Newton. *Improved machinery for compressing powder for cartridges.* (A communication.) Dated August 11, 1862.

This relates to an arrangement of machinery whereby powder may be compressed in moulds, so as to cause the grains to adhere together in the form of cartridges. The machine consists, principally, of a horizontal revolving plate, which carries a series of moulds open at the bottom, and of suitable shape for forming cartridges. These moulds are provided with moveable bottoms, and the plate is rotated by a toothed rack or racks, which gear into teeth cut round its periphery. The revolving mould plate is placed on a table which has a rising and falling motion communicated to it, so as to bring the contents of the moulds under stationary plungers, whereby the powder in the moulds will be first compressed and then discharged from the moulds by being pushed out through the bottom. One of these plungers is adjustable by a screw, so that the extent of its action may be regulated with accuracy by setting it to proper point. It may, therefore, be adjusted to suit cartridges of various sizes. The mould table is raised and lowered by a toggle joint, worked by a crank, which is driven by suitable gearing. *Patent completed.*

2240. J. Goodfellow. *Improvements in steam or water engines.* Dated Aug. 11, 1862.

This relates to improved modes of regulating the supply of steam, or fluid, to the cylinder, and cutting it off at any portion of the stroke. Instead of a stationary lap at each side of the valve, the inventor uses moveable laps connected together, but capable of being adjusted to any required distance apart, according to the power the engine is required to exert. The aforesaid laps are moved to and fro, so as to form an aperture to the port, and cut off at any portion of the stroke, either by the movement of the slide itself, or by a screw cam, or other contrivance. He also uses moveable laps to surface valves in general, so that, by moving the laps, less power is required to work the valve. *Patent abandoned.*

2241. T. Holdsworth and J. Crossley. *Improvements in means, machinery, or apparatus for warping, scouring, sizing, stretching, measuring, cooling, drying, and beaming yarns for weaving.* Dated August 11, 1862.

This consists, generally, in constructing, arranging, and combining machinery or apparatus for effecting the several purposes in one operation, and particularly in arranging the bobbin creels so that a greater number of ends or threads may be warped together than heretofore, by using supports, and by crossing the threads to prevent entanglement betwixt the bobbins and the point or place where the warp is formed. Also in taking the "lays" or "leash" or dividing the warp to form the shed by healds or heddles. Also in having the scouring troughs lined with or formed of galvanized iron, and in applying a hand lever to remove the top squeezing rollers from contact with the bottom ones when desirable in the scouring and sizing parts of the apparatus. The inventors also use rollers to traverse or travel the warp backward and forward to obtain extent of distance betwixt the squeezing rollers and beam for stretching the threads. Also they apply fans for cooling, and steam cylinders for drying the warp after the process of scouring and sizing. They also apply an index plate or indicating apparatus, so as to be actuated by one of the traverse rollers, for measuring the warp as it is passed forward to the beam, and which apparatus may also be made to mark the cutts or lengths of pieces. They also drive the beam by friction plates capable of adjustment to the stretch of tension desirable to be put upon the warp, and the bearings for the beam are so arranged as to be adjustable to the length thereof. *Patent abandoned.*

2242. W. Clark. *An improved carriage for conveying sugar moulds in sugar refineries.* (A communication.) Dated August 11, 1862.

This consists in supporting or retaining the upper parts of the mould by two adjustable horizontal plates attached to the carriage (arranged substantially as described), and also in using, in connection with the said adjustable plates, a fixed frame or plate, provided with inverted conical recesses to receive the tips of the moulds. It further consists in a novel arrangement of a castor wheel, which supports the front part of the carriage, all being so constructed and arranged as to effect the desired end. *Patent completed.*

2243. N. J. Amies. *Improvements in the manufacture of bearings or steps employed in machinery and railway and other carriages, and in a composition to be applied thereto.* Dated August 11, 1862.

This invention is designed for the purpose of dispensing with brass and other expensive metals employed in the manufacture of steps or bearings, and consists in the solution and use of malleable cast iron for the exterior or case, and in filling the interior or parts subject to friction with any well known iron metallic antifrictional composition, or with one consisting of caoutchouc, gutta percha, or other elastic gums, incorporated with plumbago, steatite, or plastic, earthy, or metallic matters, bound together atomically with vegetable or animal gums or size, and in such proportions as when dry to form a hard and solid filling for the aforesaid hollow case. This composition constitutes the second part of the invention, and may also be used for bearings by itself, the chief feature being the combination of the aforesaid ingredients, or other equivalents, to the entire exclusion of all vegetable or animal fibre, such composition exciting less friction, and, consequently, is better adapted for steps or bearings than when fibrous materials are combined therewith. The bearings, journals, or steps are to be cast of malleable cast iron, and formed with cavities or recesses for the filling of the aforesaid composition to be opposed to the frictional surface requiring lubrication, and which may be made of caoutchouc, gutta percha, or other elastic gum, one part; plumbago, steatite, or plastic, earthy, or metallic matter, three parts; and vegetable or animal gum or size, one part; or such other component parts as may be found desirable; but when water or liquid in a heated state has to come into contact with the composition, the patentee prefers to employ a gum called "rhus copallinus" (gum copal), which is better calculated to resist the action of heated liquids. This composition may be employed alone, suitably cast or formed, without the addition of wood or metal. *Patent completed.*

2244. J. Lancelott. *Improvements in the manufacture of ornamental chains from sheet metal.* Dated August 11, 1862.

The object of this invention is to substitute machine for hand labour in the manufacture from sheet metal of ornamental chains, in which differently formed blanks are used, each link of such chain being composed of an outside blank and an inside blank. The outside blank has perforations, the number of which may vary with the pattern, and in forming a chain these perforated portions of the blank must be bent upwards, so as to form a cup; another similar blank must then be placed above it, with its perforations in line with those of the blank beneath. An inside blank, having as many projecting arms as there are perforations in the outer blank, must then be placed in the topmost outside blank, in such a manner that its arms pass through the lower part of the perforations of this topmost outside blank, and the upper part of the perforations of the blank immediately beneath, the top of which must then be slightly closed inwards the better to secure the arms of the top inside blank within its perforations. *Patent completed.*

2245. M. H. Champion. *Self-closing buttons fastening without thread or needles.* Dated August 11, 1862.

These improved buttons are composed of a shank or stem bent at right angles, one end of this stem being pointed so as to penetrate through any sort of cloth or stuff, and the other end attached either to a small disc or to a button of any shape or size. When the shank is soldered to the button itself, the inventor introduces the shank up to the bend or elbow in the cloth through which it penetrates, its point entering a small spring apparatus on the other side of the material, the spring of which presses the elbow of the shank and prevents its withdrawal. When the stem or shank is not soldered to the button itself, it carries a small disc on the extremity which is not pointed, and in this case the point is passed through from the reverse side of the cloth, and passes not into a spring apparatus, as before mentioned, but into an opening in the button itself; this opening is furnished with a spring which prevents the exit of the shank. The stem or shank must always be held fixed between two opposite sides, and the object of the spring, no matter what its form, is always to prevent the point of the stem leaving this hole or sheath. *Patent abandoned.*

2246. W. E. Gedge. *Improvements in the construction of ladders.* (A communication.) Dated August 11, 1862.

This invention consists, under one modification, of a sliding ladder specially adapted for lighting gas lamps. It is formed of two ordinary straight ladders, one being fixed and with grooved uprights, the other moveable with uprights so made as to slide in the grooves of the ladder first mentioned. The movement of the ladders is effected by means of a cord attached to the lowest round of the moveable ladder and passing through a pulley on the topmost round of the fixed ladder. The strong hooks on the top of the uprights of the moveable ladder permit its being attached to the spot which it is desired to attain. This ladder offers the advantage of reaching any desired height without being embarrassing, and it will be found useful for many purposes other than lighting gas lamps. *Patent abandoned.*

2247. J. Combe and J. H. Smallage. *Improvements in the action and arrangement of machines for winding cops, and in apparatus for holding and receiving such cops when used for warps or sewing thread or other purposes.* Dated August 11, 1862.

We cannot here give space to the voluminous details of this invention. *Patent completed.*

2248. H. Donald. *Improvements in machinery for shearing, punching, and rivetting metals.* Dated August 11, 1862.

This invention relates to a previous patent dated 11th April, 1853 (No. 867), and comprises much detail which we cannot quote here. *Patent abandoned.*

2249. A. J. Martin, J. Goss, and J. Bush. *Improvements in apparatus for distillation.* Dated Aug. 11, 1862.

This invention consists of improvements in apparatus for the purpose of distillation of mineral oils, spirits, and other liquids. The appararus consists of a vertical cylindrical chamber of copper closed at the bottom, and having a moveable cap or cover, or head of the required shape, which is secured by nuts and screws, or in any other manner, so as to be rendered air-tight. Through the cap or cover, or through the upper part of the cylindrical chamber, or any part of the case most convenient, a pipe enters, communicating with a reservoir containing the liquid to be distilled. In the interior of the chamber a series of copper pans is fixed, one above the other, from bottom to top of the chamber, and the liquid to be distilled flows from the reservoir through the pipe into the uppermost pan, whence it runs over into the second pan, and so on to the lowest by reason of each pan having an edge or lip turned down so as to allow the liquid to overflow at such edge. Each of these pans has a false bottom, communicating with two vertical pipes, one on each side of the pans. A pipe, running the whole length of the pans, and coming out of the lower part of the still, and supplied with a tap, with branch pipes from the bottom or side of each pan, may, when needed, be added, so as to draw off any residuum remaining in the pans when they have done working. These pipes are furnished with a supply of steam from a boiler, which steam enters one pipe and circulates throughout the series of false bottoms of the pans, and is carried off by an exit-pipe connected to the other vertical steam-pipe, the excess of liquid to be distilled, overflowing the lowermost pan, being carried away by a pipe to a tank or reservoir; it may thence be passed into a second apparatus, its temperature having been increased by the action of the first; or the liquid may remain in the tank or reservoir and be removed when required. *Patent completed.*

2250. R. Gresty. *Improvements in scarfs or cravats.* Dated August 11, 1862.

In carrying out this invention, the inventor proposes covering a piece of card, buckram, or other suitable stiff material with any description of satin, silk, or other material of which scarfs are ordinarily composed, and then crossing two pieces one over the other to form the ends thereof, the interior being padded. The piece of stiff material is hollowed out at top to fit the front of the neck, and it is to be about four or five inches square, or may be oblong, deeper and narrower, to fill up the space or opening of the waistcoat. Thus it will appear that, when it is placed on the breast, it only requires a piece of elastic material to fasten on to or around the shirt button of the neck to keep the cravat up in its position. the top corners thereof passing under the corners of the collar; or in lieu of a piece of elastic a button, buttons, studs, or hooks, may be attached to the back of the cravat and placed in the button-hole of the shirt front, thereby keeping it always in its proper place. *Patent abandoned.*

2251. W. Macnab. *Improvements in steam boilers and in apparatus for feeding the same, and for effecting circulation therein.* Dated August 12, 1862.

This invention relates—1, to internally-flued cylindrical boilers for steam of moderate pressure, and partly to boilers for high pressure the heating surface of which consists principally of tubes with the water inside them. In the improved cylindrical boiler there may be one or two large furnace tubes, the back ends of which open into a combustion chamber communicating with a number of small tubes by which the gases return to a smoke-box at the front. The front mouth or mouths are made to project forward from the main body of the boiler as far as the front of the smoke-box, being surrounded by a kind of annular water space. The gases return from the smoke-box to the back by two or more comparatively large flue tubes traversing the steam space of the boiler. Two or more of such boilers may be conveniently arranged side by side, or one, two or more pairs may be arranged back to back, and communicating with a single central funnel, but having separate combustion chambers, into which provision may be made for introducing air. To give sufficient steam space a cylindrical steam receiver may be laid along the top cavity between the two boilers of each pair, and an additional flue tube may be passed through each receiver. The improved apparatus for feeding boilers and for effecting circulation therein, consists, according to one modification of a steam cylinder directly connected to the piston or bucket of the pump, the parts being proportioned so as not to work at an excessive speed. The motion of the piston is reversed by means of a tumbler movement acting on the valves and reversing them suddenly as each end of the stroke is reached. *Patent abandoned.*

2252. J. Ramsbottom and G. Hacking. *Improvements in machinery or apparatus for measuring and registering the flow of water and other fluids.* Dated August 12, 1862.

This invention consists in applying to water meters swing hinges, partly similar to those used in dry gas meters, to be placed at or near each end of a cylinder or measuring chamber, having rods which pass through stuffing-boxes in the sides or ends. The said rods are to be connected in such a manner that, as the piston, during its motion from end to end of the cylinder or chamber, forces one hinge outwards, the other hinge will, at the same time, be forced or drawn inwards to be, in its turn, similarly acted on by the piston during its return stroke, and from the bar connecting the two hinges the requisite motion will be obtained to actuate the valve and registering apparatus, either by means of a tumbler, or other more direct manner. Or the said bar may be constructed so as to actuate a valve, or the two hinges may be made to serve the purpose of valves, in order to supply fluid to a piston-valve, which may be actuated by the pressure of the fluid. *Patent abandoned.*

2253. J. Dickson. *Improvements in treating zinc ores and solutions of zinc to obtain zinc therefrom.* Dated August 12, 1862.

The usual method of obtaining zinc from its ores is, after the preliminary sorting and washing, to expose the said ores mixed with a carbonaceous matter to a full white heat for many hours, and during that time to slowly distil the zinc from the said ores. By the present method, the inventor first precipitates metallic zinc from aqueous, acid, saline, or alkaline solutions of zinc obtained from the said ores of zinc, either by washing the said ores and then adding them to water, or other suitable solvents, or by treating the said ores at once with suitable acids, alkalies, or salts, and then transmitting a current of voltaic electricity obtained from inexpensive sources of that power through any of the said solutions of zinc, by means of suitable anodes and cathodes unmixed therein, the metallic zinc in this case being precipitated on the said cathode employed. *Patent abandoned.*

2254. J. Dickson. *Improvements in treating ores and solutions of lead to obtain lead therefrom.* Dated August 12, 1862.

In carrying out this invention, according to the first method, the inventor precipitates metallic lead from aqueous, acid, saline, or alkaline solutions of lead obtained from ores of lead, either by washing the said ores, if they require such treatment, and then adding them to aqueous solutions of common salt, or to other suitable solvents. Or the solution of lead used is that which is the product of voltaic batteries in which lead has been used as a positive pole. The solution of lead obtained is heated to a temperature of 212 deg. Fah., and then decomposed by the influence of a current of voltaic electricity derived from inexpensive sources of that power whereby its metallic lead is precipitated or deposited. By the second method, he obtains lead from its ores or from chemical compounds of lead which are sufficiently rich in lead, by subjecting the said ores or compounds in a state of fusion to the action of a current of voltaic electricity, by immersing carbon or other suitable anodes and cathodes into the said fused ores or compounds, and then respectively connecting the said anodes and cathodes with the negative and positive poles of a voltaic battery. *Patent abandoned.*

2255. L. Serbat. *Certain improvements in lubricating machinery.* Dated August 12, 1862.

This invention consists in employing napthaline, either alone or mixed, or combined with other substances; for lubricating parts of machinery. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Nov. 21, 1862.

3129. W. E. Gedge, 11, Wellington-street, Strand. An improved elastic fastening for gloves. (A communication.)

Dated Jan. 12, 1863.

98. A. I. Mahon, 25, Leinster-square, Rathmines. Improvements in screw and paddle propellers, and a submarine propeller, also applicable to the raising and forcing of water or other fluids.

Dated Jan. 16, 1863.

228. A. Smith, Mauchlin, gentleman. Improvements in certain parts of staples, locks, bolts, latches, and other similar fastenings.

Dated Jan. 30, 1863.

277. J. W. Branford, merchant, March, Cambridge. Improvements in horse-hoes, and in the means of using the same in husbandry.

283. W. E. Gedge, 11, Wellington-street, Strand. Improvements in hair nets. (A communication.)

Dated Feb. 2, 1863.

294. J. Gibson, Heptonstall, Halifax, manufacturer. Improvements in looms for weaving.

Dated Feb. 6, 1863.

334. A. Johnston, Comely Bank, near Edinburgh, gentleman. Improvements in the propulsion of vessels.

336. A. Clark, Staines, carpenter. Improvements in knife-cleaning apparatus.

338. W. Robins, 4, Dame-street, Islington, engineer. Improvements in the construction of fire-lighters, or faggots.

340. R. D. Tivnann, Wordsley Brass Foundry, Stafford. Improvements in holster boxes, or boxes for screws or pins to work in, and in the manufacture thereof.

Dated Feb. 7, 1863.

342. J. Cameron, Hematite Iron Works, Barrow-in-Furness, chemist. Improvements in the manufacture of iron and alloys of iron.

344. J. Mallison, jun., Bolton-le-Moors, yarn agent. Certain improvements in the process and method of dyeing yarns.

346. W. T. Cooper, Tooley-street, rectifying distiller. Improvements in distilling apparatus.

348. W. Clark, 53, Chancery-lane, engineer. Improvements in the application of gas for the preparation of woodwork generally and iron ships, for their better preservation and reception of paint, or other protecting coating, and for disinfecting ships, hospitals, and other places. (A communication.)

350. J. Miller, Glasgow, pottery manufacturer, and W. Struthers, Hamilton, gentleman. Improvements in securing the corks, stoppers, or lids of bottles, jars, and other similar vessels.

352. G. Redrup, Loughborough, brewer. Improvements in machinery for the cutting of shives, bungs, corks, spiles, and vent or other pegs, and also in machinery for manufacturing the knives, or cutters, employed therein; such machinery being also applicable to the manufacture of trenails, and other cylindrical and conical articles.

Dated Feb. 9, 1863.

354. B. Dobson and E. Barlow, Bolton, machine makers. Certain improvements in carding engines. (A communication.)

358. G. Goucher, Worksop, ironfounder, engineer, and machinist. Improvements in regulating the admission of air into the furnaces of steam boilers.

360. W. B. Rooff, 7, Willow-walk, Kentish-town. An improved respirator.

Dated Feb. 10, 1863.

362. T. Hill, Hampton House, Great Warley, brewer. Improvements in the arrangements employed for the protection of markers at rifle butts.

364. M. Wigzell, Strand, Topsham, Devon. Improvements in machinery or apparatus and method to be used in the manufacture of every description of candles, tapers, and other lights.

366. J. F. Bottom, Nottingham, lace dresser. Improvements in the means or apparatus for dressing lace and other fabrics.

Dated Feb. 11, 1863.

368. A. Corneau, Charleville, France, ironfounder. An improved hot air stove.

370. E. T. Hughes, 123, Chancery-lane. Improvements in apparatus for drilling wood, stone, iron, or other materials. (A communication.)

372. D. Radcliffe, Liverpool, plumber. Improvements in valve taps.

376. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in photographic apparatus. (A communication.)

Dated Feb. 12, 1863.

380. E. Kemp, manager, J. Needham, and O. Robinson, overlooker, Ashton-under-Lyne. Certain improvements in self-acting mules for spinning.

381. A. Morton, Arbroath, Forfar, engineer. Improvements in lawn mowing machines.

382. W. Clark, 53, Chancery-lane, engineer. Improvements in the bearing-surfaces of shafts and other axles. (A communication.)

383. S. H. Phillips, Newgate-street. An improved fastening for purses, portmonnaies, pocket books, bags, reticules, and such like purposes.

384. S. Lamb, Whitehall Works, Leeds, engineer and machine maker, and J. Spink, Oxford-road, Sheffield, joiner. Improvements in machinery for tenoning, grooving, sawing, and otherwise cutting wood.

Dated Feb. 13, 1863.

385. G. H. Birkbeck, 34, Southampton-buildings. Improvements in processes or means employed for separating or extracting silver or other metals from lead. (A communication.)

387. W. E. Gedge, 11, Wellington-street, Strand. Improved table apparatus for promoting the comfort of persons at sea. (A communication.)

389. J. F. Spencer, Newcastle-on-Tyne, engineer. Improvements in steam engines.

391. J. Grantham, 31, Nicholas-lane, civil engineer. Improvements in hydraulic presses.

395. J. A. Schlumberger, Golden-square, chemist. Improvements in treating coal tar dead oils, and for producing phenic or carbolic acid. (A communication.)

Dated Feb. 14, 1863.

403. W. Baylis, joiner, Hulme, and T. H. Hopwood, hosier and engineer. Improvements in tongs or forceps for grasping articles out of reach of the hand.

405. J. Lewis, 5, Wych-street, Strand, engineer and model maker. Improvements in driving sewing machines.

407. T. Thorne, Southsea, carpenter. Improved apparatus for disengaging ships' boats.

409. A. J. Fraser, Water-lane, Great Tower-street. Improvements in window furniture or fastenings.

413. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in wrought-iron casements, and in the means for fastening the same, which improvements are also partly applicable to the framework of glass doors, conservatories, and similar structures. (A communication.)

Dated Feb. 16, 1863.

415. J. W. Crossley, Brighouse, York, dyer and finisher. Improvements in press papers, and in the method or means of drying them, or other similar sheets of paper; applicable also for the drying of woven fabrics, yarns, wool, cotton, or other fibrous substances.

417. W. C. McEntee, Birmingham, merchant, and G. and T. Withers, West Bromwich, fireproof safe manufacturers. Improvements in locks.

419. H. Smith, 3, Regent's-park-terrace, Gloucester-gate. Improvements in apparatus for feeding horses.

421. W. Jackson, Liverpool, engineer. Improvements in pumps.

423. S. W. Clough, Stanningley, York, manager. Improvements in signalling on railways.

425. T. Wilkinson, Rathmines, commercial clerk. Improvements in machinery or apparatus for singeing pigs.

Dated Feb. 17, 1863.

427. J. Lee, Church-gate, Leicester. Improvements in ploughs and harrows.

429. W. C. Ford, Brooklyn, New York. An improvement in paddle-wheels.

433. G. Home, Kensall-green. Improvements in projectiles.

435. S. Pluchart, Paris, France, gentleman. A new kind of food for horses.

437. D. Tassin, 30, Rue du Collège, Liège, engineer. Improvements in preventing the explosion of steam boilers.

Dated Feb. 18, 1863.

441. J. Barker and E. Moss, Manchester, engineers. Improvements in portable and stationary crabs or cranes.

443. J. H. Bly, Great Yarmouth, ironmonger. Improvements in cooking stoves.

447. F. J. Reed, 3, Gresham-street. Improvements in apparatus for traversing guns. (A communication.)

449. J. Puntis, Above Bar, Southampton, and G. Cox, Throgmorton-street. Improved appliances for displaying in the open air or indoors illuminated designs, devices, mottoes, or announcements, and in which jets of gas are employed as the illuminating agent.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, March. 3, 1863.

2748. A. V. Newton. Evaporating apparatus. (A communication.)

2825. H. L. Emery. Propelling machinery actuated by the application of animal power.

2831. S. Whitham and T. Wright. Manufacture of iron and steel.

2833. C. Clark. Cigar tubes.

2838. G. Haseltine. Manufacturing nails and brads. (A communication.)

2840. C. Tress and F. C. Belhomme. Hats, caps, and bonnets.

2841. G. Clark. Construction, protection, and armament of ships, vessels, and floating batteries, some of which improvements are applicable to land batteries.

2852. W. S. Gamble. Salinometer.

2860. E. H. Carbutt and G. A. Clough. Power hammers.

2862. R. A. Brooman. Tanning. (A communication.)

2865. L. Groux. Manufacture of soap.

2871. G. and W. Lake. Stirrup.

2873. W. Owen. Stoves.

2885. J. H. Johnson. Heating glass furnaces. (A communication.)

2886. H. C. R. Joubert. Music stools, chairs, or seats.

2890. F. L. H. W. Bilnger. Condensation of steam. (A communication.)

2891. J. J. Ridge. Treating certain farinaceous substances.

2892. P. E. Placet. Engraving.

2894. A. Peek. Evaporating saccharine and saline solutions.

2900. E. and A. Tatham. Manufacture of looped fabrics.

2922. F. L. Stott. Warping yarns or thread.

2930. G. Piggott. Punching, shearing, and rivetting sheets or plates of iron and other metals and alloys.

2931. P. Giffard. Air guns and other air-arms.

2937. W. R. Bowditch. Carburetting or naphthalizing gas.

2952. W. Jenkins. Apparatus for cutting coal.

2959. W. E. Newton. Drying grain and other substances. (A communication.)

3011. W. Clark. Utilizing refuse and azoted matters of commerce. (A communication.)

3033. J. Easton, jun., and J. C. Amos. Sawing wood.

3051. J. A. Duntze. Communicating rotary motion to shafts or axles for various purposes. (A communication.)

3174. J. R. Danks, and B. P. and R. P. Walker. Boot and shoe heel and toe tips, and clog irons.

3190. F. Boecke. Sewing or uniting fabrics.

3195. J. F. Delany and J. C. R. Okes. Double-cylinder expansive steam engines,

3252. J. Braddock. Machinery or apparatus for effecting the separation of impurities from the water employed in steam boilers.

3464. A. W. Sleigh. Rendering or making ships and vessels and floating and shore batteries, or ambulant or stationary defences, impenetrable to shot and shell.

241. D. E. Hughes. Apparatus for effecting telegraphic communications.

267. J. Pouncy. Obtaining, transferring, and printing from photographic pictures or images.

313. G. Haseltine. Uniting metallic surfaces. (A communication.)

338. W. Robins. Construction of fire-lighters or faggots.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Feb. 27, 1863.

2433. A. Johnston.
2438. W. H. Atkinson.
2440. E. Dyson.
2441. R. A. Brooman.
2443. P. J. Bossard.
2448. H. L. Emery.
2450. J. Platt and W. Richardson.
2460. S. H. Huntley.
2462. S. Pudney.
2472. J. Hartshorn and W. Redgate.
2476. A. J. Alderman.
2493. A. Rigg.
2507. J. and F. Walker.
2510. A. Whytock.
2511. A. E. H. B. Butler.
2541. S. Flexen.
2646. J. Bucknall.
3259. R. Hornsby.

Sealed March 3, 1863.

2453. H. W. Hart.
2451. S. H. Hadley.
2459. J. R. Johnson and J. A. Harrison.
2461. J. Snider.
2463. H. Hughes.
2464. E. L. Duncan.
2469. F. D. Artingstall.
2474. G. W. Belding.
2481. W. Hirst.
2487. W. Rothera.
2489. J. Vigouroux.
2504. J. Thomson.
2508. P. Ward.
2509. T. Molineux.
2555. J. H. Johnson.
2563. T. Watts.
2605. W. Maddick.
2729. J. B. Palser.
2735. J. Lowe and J. Harris.
2792. G. T. H. Pattison.
2793. G. T. H. Pattison.
2794. H. A. Rèmiére.
2818. J. Tangye.
2824. J. B. Payne.
2857. M. C. A. Perkes.
3123. J. W. Hjerpe, W. Holmgren, and A. V. Sundstedt.
3163. G. Henderson.
41. W. E. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

504. R. A. Brooman.
519. C. W. Siemens.
505. J. J. Baranowski.
543. E. I. Asser.
537. P. H. Desvignes.
828. R. Lakin and J. Wain.
546. G. Weir.
578. H. Bessemer.
590. W. Bauer.
2287. T. Briggs.
542. R. Walker.
589. W. G. Ramsden.
615. P. Hugon.
573. D. Chadwick and H. Frost.
594. C. Schiele.
629. T. Veal.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

528. J. Reading.
562. H. D. Pouchin.
512. J. Fowler, jun., and D. Greig.
538. R. Maynard.
534. F. Kaselowsky.
630. H. Bessemer.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending February 28, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2068	0 4	2078	0 8	2088	0 8	2098	0 10	2108	1 0	2118	0 4
2069	0 4	2079	0 10	2089	0 4	2099	0 8	2109	0 4	2119	0 8
2070	1 6	2080	0 4	2090	0 4	2100	0 4	2110	0 4	2120	0 6
2071	1 0	2081	0 4	2091	0 10	2101	0 10	2111	2 4	2121	0 10
2072	0 4	2082	0 8	2092	1 2	2102	0 4	2112	0 4	2122	0 4
2073	0 4	2083	1 0	2093	0 8	2103	0 8	2113	0 8	2123	0 4
2074	0 8	2084	0 4	2094	0 4	2104	2 4	2114	0 10	2124	1 4
2075	0 4	2085	0 4	2095	0 4	2105	0 10	2115	0 4	2125	0 4
2076	0 4	2086	0 4	2096	1 0	2106	0 8	2116	0 4	2126	0 10
2077	0 8	2087	0 4	2097	0 4	2107	0 4	2117	0 4		

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Timber, duty 1s. per load, drawback, 1s.

		£	s.	£	s.
Teak	load	14	0	15	0
Quebec, red pine		3	10	4	10
,, yellow pine		3	0	4	0
St. John, N.B., yellow		5	0	5	10
Quebec oak, white		5	10	6	10
,, birch		3	0	3	10
,, elm		3	10	5	0
Dantzic, oak		3	10	6	10
,, fir		2	10	3	10
Memel, fir		3	0	3	5
Riga		3	0	3	5
Swedish		2	10	2	15
Masts, Quebec red pine		5	0	6	0
,, yellow pine		5	0	6	0
Lathwood, Dantzig, fm.		5	10	6	10
,, St. Petersburg		8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					
Quebec, white spruce		15	10	19	10
St. John, white spruce		14	10	16	10
Yellow pine, per reduced C.					
Canada, 1st quality		17	0	18	0
,, 2nd do		11	0	12	0
Archangel, yellow		13	0	13	10
St. Petersburg, yellow		11	10	12	0
Finlan		9	0	10	0
Memel		10	0	15	0
Gothenburg, yellow		10	0	11	0
,, white		9	0	9	10
Gefle, yellow		10	0	11	10
Soderhamn		9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.					
,, yellow		21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.		0	14	1	4
Pumice Stone. per ton		5	10	9	0

OILS, &c.

		£	s.	£	s.
Seal, pale	per tun	48	0	0	0
Sperm body		85	0	86	0
Cod		47	10	48	0
Whale, South Sea, pale		43	10	0	0
Olive, Gallipoli		59	0	0	0
Cocoanut, Cochin		53	10	54	0
Palm, fine		38	0	38	10
Linseed		43		0	0
Rapeseed, English pale		54	0	0	0
Cottonseed		34	0	44	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
Iron:									
Welsh Bars, in London	per ton	6	10	0	to	7	0	0	2½
Nail Rods	,,	7	5	0	,,	7	10	0	,,
Hoops	,,	8	10	0	,,	9	0	0	,,
Sheets, single	,,	9	10	0	,,	9	15	0	,,
Staffordshire Bars	,,	7	15	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	17	6	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	14	0	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
Steel:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	10	0	,,	18	0	0	,,
Copper:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8½	,,	0	0	8½	
Fine Foreign	per ton	95	0	0	,,	96	0	0	3
Tin:									
English Block	pr cwt.	5	19	0	,,	0	0	0	2½
Bar	,,	6	0	0	,,	0	0	0	,,
Refined	,,	6	4	0	,,	0	0	0	,,
Banca	,,	6	2	6	,,	0	0	0	nett
Straits	,,	6	1	0	,,	6	2	0	,,
Tin plates:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
Lead:									
Pig, English	per ton	21	0	0	,,	21	10	0	2½
Spanish, Soft	,,	20	7	6	,,	20	10	0	,,
Shot, Patent	,,	23	15	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	0	0	0	,,
Spelter:									
On the spot	,,	18	5	0	,,	18	7	6	nett
Zinc:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
Quicksilver	pr btl.	7	0	0	,,	0	0	0	3
Regulus of Antimony:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

On Monday evening last, Capt. Selwyn read a paper before the Inventors' Institute on the Progress of Submarine Telegraphy, especially as regards the various inventions used for the submergence of telegraphic cables. Sir E. Belcher occupied the chair.

The *Times*, Sept. 15, speaking of Benson's Modern and Antique Watches in the Exhibition, says—"As affording the most striking contrast, Mr. Benson shows with these a fresh exhibition of modern watches, with cases made from prize designs at the South Kensington Museum, some of which are fine specimens of engraving."—Chronometers, duplex, lever, horizontal, repeaters, centre seconds, keyless, split seconds, and every description of watch, adapted to all climates. Benson's Illustrated Pamphlet on Watches (free by post for two stamps) contains a short history of watchmaking, with descriptions and prices. It serves as a guide in the purchase of a watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world, to select a watch, and have it sent free and safe by post.—J. W. Benson, Prize Medallist, 33 and 34, Ludgate-hill, London. Established 1749.—[Advertisement.]

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MARCH 13, 1863.

VENTILATION OF SHIPS.

One of the subjects brought under the notice of the Institution of Naval Architects at their last meetings, and appearing in the new volume of "Transactions," to which we referred last week, is ventilation.

Shipbuilders, and especially those of the Royal Navy, are just beginning to see the importance of this subject. In the olden times, the only fresh air which got to the orlop decks and holds of men-of-war and Indiamen, was that which found its way through the hatches and down into the dark depths of the ship, when the warm bodies of the men or beasts immured there, raised the temperature of the imprisoned air and favoured its escape.

On the decks, which were sufficiently high above the water to allow side scuttles or ports to be cut, it might be supposed that there would generally be a good current of pure air. But this was by no means the case. In a man-of-war, the lowest of these decks is that commonly allotted for the sleeping accommodation of the crew, and they are confined to this deck. Hammock-screws are placed in the beams overhead, so as to use the whole of the available space, allowing to each man a width of 16 in. The men are thus packed as closely together as negroes in the hold of a slaver. As the hammocks are slung within 2 ft. of the beams, the men breathe through the night the heated air which passes off from their own bodies and lungs. This can hardly fail to be injurious to them even under the most favourable circumstances; as, for example, when the temperature of the external air is 30 or 40 deg. below that of their bodies, in which case the open hatchways would permit a certain amount of circulation of air between the decks.

But the case would often be as follows:—There would be five or six hundred men, often more, suspended thus above the "lower deck" of a line-of-battle ship; the temperature outside the ship 90 deg. and upwards, and consequently no motion of the air between decks. To make matters worse, the ports would all be closed according to the regulations. The coolest part of the ship would be the holds, from which, perhaps, a faint current would ascend through the spaces between the timbers, and then issue through the openings between the beams upon the sleeping deck. This air would, of course, be charged with the foulness generated by the decay of sawdust, chips, and refuse stores, in the fœtid bilge-water.

Such being the facts of the case even now in our own ships, we must not be surprised to learn that low fevers and pulmonary diseases are alarmingly frequent among a class of men whose hardy lives, compulsory regularity of habits and abstemiousness, ought to produce the most robust health.

Very much might have been done in sailing ships to avoid these evils. The overcrowding of the men, for example, was capable of instant remedy, by appropriating the other decks for sleeping accommodation. But the introduction of steam gave at once an enormous ventilating power, which only needed proper direction in order to give the needful circulation of pure air through all parts of the ship.

It is only, however, within the last two or three years that any attempts have been made to effect this most desirable end, either in the Royal Navy or in passenger ships. In men-of-war, there is considerable difficulty in getting sufficient space on the deck, clear of the guns, for hatchways and scuttles, upon the number and extent of which the success of any system of ventilation must largely depend. But in merchant ships, governed by no such restrictions, there is still grave matter of complaint. The Great Eastern, to take a notable example, has no provision whatever for employing her furnaces as ventilators for the ship. She is dependent upon the hatchways and skylights upon the upper deck, and the scuttles in the side for the supply of air to the entire ship.

The steam vessels which carry the mails between Holyhead and Kingstown, and those belonging to the same company which run with passengers and live stock between Dublin and Liverpool, form an exception to the general rule.

The engineer-in-chief to this company, known as the City of Dublin Company, describes, in a Paper which appears in these "Transactions," the methods adopted by him for securing the excellent ventilation which has been noticed by every observant passenger in these vessels.

The frequent necessity to close the hatches in bad weather, when the hold was crowded with cattle or the lower decks with troops, compelled them to adopt some device for creating an artificial current between decks. The first means adopted was a large fan, worked by a belt in connection with the engine. This was not only large and cumbrous, but it failed to give more than very partial relief. The air in the holds in which the cattle were confined was so foul, that the men in charge were frequently unable to keep their lights burning.

Being thus driven to devise some other mode of obtaining fresh air, Mr. Clarke introduced the fan-engine, patented by Schiele and Williams, of Oldham. In this machine, the fan and a small turbine engine are combined, and a steam pipe being led to it from the boilers, a very small supply of steam is found to be sufficient to keep it in efficient work, which it performs quite noiselessly.

In these vessels, a hollow trunk of about 100 square inches in section, is placed at one side under the deck, the entire length of the vessel. In an iron ship, this may be a box-stringer.

With this main trunk smaller ones are connected extending into the holds, each having a wide mouthpiece to collect the noxious vapours which are to be removed.

The main trunk is then connected with the fan-engine, which is placed on deck near the boiler, or in the engine-room, and a 1-in. pipe is led from the boiler to the engine, with a pressure of 10 lbs. of steam or upwards. The waste steam after working the fan-engine passes to the ordinary waste steam pipe on deck. By this means, complete ventilation by exhaustion may be effected.

Mr. Clarke tells us that an attempt was made to discharge the air, drawn off from the hold in which the cattle were confined, into the stoke room, for the purpose of supplying furnaces with air. But this had to be discontinued, as the foul air was too offensive to the firemen.

The engine may also be employed for the propulsion of air. It has been so employed in the Holyhead packets with perfect success; providing a due supply of air to the stoke-rooms and furnaces, and keeping the air in the cabins and store-rooms quite pure.

We are happy to find that the subject is now attracting the attention of the Government. About eighteen months since a committee was appointed by the Admiralty to consider the subject and report upon the best means of providing proper ventilation for ships of war. In some of these, the difficulties are now greatly increased by the necessity for making the sides shot proof, and for reducing the number and size of those ports and scuttles in the sides, which have hitherto done much towards promoting the circulation between decks.

This difficulty has made itself felt in the French iron-cased ships in the Gulf of Mexico; and the defective ventilation in those ships has produced disease among their crews to a most alarming extent.

With proper precautions this may certainly be avoided; and the Admiralty will, we hope, take care that in our iron-cased ships no precaution is neglected.

THE PATENT RIGHT OF FOWLER'S STEAM BALANCE-PLOUGH.

Like the history of cotton and other manufactures, or like that of the steam-engine itself, so is the history of steam-ploughing a record of some 500 successive patents. The admirable indices of Mr. Woodcroft afford the greatest facilities for tracing the progressive development of the applications of practical mechanics, now playing so large a part in modern life. There is the same series of appearances in most of these engineering histories; a number of impracticable schemes, evidently born and expired in the brains of their projectors, form the foundations for later and more rational undertakings. Two of the most successful early attempts at steam-ploughing by means of rope traction, owe their origin to wealthy amateurs—a fact easy to be accounted for, as only a wealthy man could undertake a course of experiments in steam-ploughing. The opponents of patent right often overlook the truth, that practical mechanics is an experimental and tentative scientific art, and that to bring a new mechanical scheme to a successful issue requires a long purse as well as a long head. How many men could be found to spend thousands in gratuitously establishing truths that can only be arrived at by expensive experiments — truths that would merely afford a basis for others to step in and reap what the first experimenters had sown? The partially successful attempts made by the Marquis of Tweeddale and by Lord Willoughby d'Eresby, show how difficult it is to bring new mechanical undertakings to maturity without the fostering influence of the patent laws. A princely fortune was required before the steam-plough could be brought to its present state of development. Even a very rich nobleman must ride his hobby most furiously before he would expend £60,000 to keep it on its legs. Besides, what aid could be expected from capitalists without the hope of some returns in the case of success?

Even genius is powerless without capital, and the courage and foresight to spend the money profitably. One of the most important patents that have conduced to the present success of steam-ploughing owes its origination to two men of great original mechanical ingenuity, but unprovided with the necessary funds for practically working the invention. This patent had to fall into the hands of Mr. John Fowler, a man of capital as well as ingenuity, before it could be brought to maturity. Mr. Fowler had directed his attention for some time to a kindred pursuit to steam-ploughing, having, as early as March 7th and October 17th, 1850, taken out two successive patents for draining ploughs. Both of these inventions are described in the MECHANICS' MAGAZINE—the first in Vol. 53, page 518, the second in Vol. 54, page 337. He was thus practically prepared to solve the problem of steam-ploughing, just as in a more important instance Stephenson was prepared, by years of experiment in locomotive traction, for the great trials on the Manchester and Liverpool Railway. An illustrated account of Fowler's steam-ploughing tackle will be found in Vol. 1, page 395, and a further account in Vol. 2, page 41 (New Series).

Mr. Fowler's inventions are now come to the last stage of most successful and new mechanical undertakings. Once stamped by success, they are immediately attacked by those who would like to reap without having sown—by men similar to those who, in the preceding century, were successful in robbing Crompton and Hargreave of their inventions, and in condemning these benefactors of their country to poverty. Fowler's patents, the hardly-earned fruits of indomitable courage and perseverance, are now sought to be set aside by men like those who succeeded in breaking down Arkwright's patent, and who attempted the same enterprise against Watt's patented inventions. Our law books are unfortunately full of the records of such patent trials. These attempts are but too often successful in depriving men of genius of the only properties that they can carry to their graves, namely, ideas and inventions. The following is a short account of the great patent trial that has lately so much engaged the attention of the engineering world:—

The case was tried in the Court of Common Pleas, Guildhall, before Lord Chief Justice Erle, and a special jury. Messrs. James Beadel and Richard Lake, in whom, as trustees, the patents are vested, were the legal plaintiffs, while the Messrs. Howard, the well-known agricultural implement makers, of Bedford, were the defendants. Mr. Bovill, Q.C., Mr. Hindmarch, Q.C., and Mr. Aston were counsel for the plaintiffs; while Sir Fitzroy Kelly, Q.C., Mr. Webster, and Mr. Barrow appeared for the defendants. On Saturday, Feb. 21st, Mr. Aston opened the case, and stated that the action was brought for the infringement of two several patents—the first of which was granted to David Fiskin and Thomas Robert Fiskin, and was dated 19th July, 1855 (No. 1629, price 1s. 5d);[*] and the second was granted to John Fowler, jun., and David Greig, Feb. 28th, 1856 (No. 512, price 9d). Although we believe ourselves to be correct in asserting that the Messrs. Howard have infringed several other patents of Mr. Fowler's, nevertheless, probably to simplify the case for the comprehension of the jury, the action was only brought for infringing the patented design for a balance-plough. The pleas for the defendants were, that they were not guilty, and that the letters patent of the plaintiffs were invalid, owing to a want of sufficiency in the specification. These two pleas somewhat contradict each other. If the defendants did not infringe the patents, it mattered very little whether they were valid or not. The second kind of plea always seemed to us to be of a doubtful description. In our number for Feb. 6th, we showed the influence of the patent law on the life of Watt, the principal inventor of the steam-engine. We there stated that the *formal* objections against Watt's patent, act, and specification, seem to have been much stronger than those which were successively urged against Arkwright's patents. In fact, the specification of 1769 did *not* put the public in possession of the invention. *Nevertheless, the mere fact of attacking the patent, on the score of its being informal, showed great immorality on the part of the pirates; a technical defect in a title-deed does not give an honest right to another's land.* Fortunately for Watt, England, and the world, right at last prevailed, and Watt long afterwards used to call the specifications his old and "*well-tried* friends." The history of the past has been said, with no less poetry than truth, to be the mirror of the future; and we thus find a patent case of the latter half of the 18th, repeating itself in the latter half of the 19th century.

Mr. Bovill, in the course of his very able and lucid speech for the plaintiffs, asserted that, "when the patent of Messrs. Fiskin was taken out, the problem of ploughing by steam was solved, and the first approach was made to the construction of a really useful and serviceable steam-plough." To this we fully agree; and we regard No. 1629, date 1855, as the most momentous patent in the history of ploughing by steam. This patent is a further interesting instance of the oft-recurring fact that the most original inventions are often made by outsiders. Mr. William Fiskin is a Scotch Presbyterian minister; while the two other brothers are, or were, schoolmasters in Scotland. The patent has been amended by a disclaimer striking out that which relates to the endless rope; it specifies the construction and use of the plough and of the anchor.[*] Not merely does it thus embody the principle of the balance-plough, but also what appears to us to be an indispensable principle whenever rope traction is used—that of making the anchor self-acting by means of the rope. The use of direct action tackle is evidently only possible to those in possession of this principle. The Messrs. Howard are no doubt well aware of the importance of this plan, and accordingly endeavoured to prove that Mr. Rogers, of Stockton-on-Tees, had invented this arrangement. Mr. Rogers was employed by the Messrs. Fiskin to make the plough, &c., according to a model furnished by the brothers. This witness asserted that he had first invented the self-acting anchor, and that it was inserted in the complete specifications after the provisional specification of Messrs. Fiskin's patent was filed. The self-acting anchor is certainly not described in the provisional specification—a fact of itself sufficient (as proved by several recent legal decisions) to upset the whole patent. Mr. Bovill further described that part of Messrs. Fiskin's invention relating to their balance-plough. In the specification of July 19th, 1855, this plough is described as follows:—"The ploughs or other implements employed are supported in the extremities of forked levers, which are connected to a slotted lever by a bell crank and connecting rod, by means of which the implements are alternately raised out of or lowered into the land, so that while one set is in action the set on the opposite side of the bell crank is out of work. The power for raising and lowering the ploughs is communicated through an endless screw, which gears into a toothed quadrant, carried upon the axis of the slotted lever." It appears to us very probable that the Fiskins did not at first perceive the full value of the balance principle, but merely looked upon it as somewhat facilitating operations at the headlands. The full advantage to be obtained was realized in the patent for the present balance-plough, taken out by Messrs. Fowler and Greig about seven months later than the date of the Fiskin patent. They describe it as follows:—"Several ploughs or tilling instruments are placed at each end of a frame, in order that when the implements at one end of the frame go out of work, the implements at the other end of the frame may come into action; the frame is mounted on an axle in the huddle, and moves thereon as on a fulcrum. The machine has two or more wheels to run on, and is moved to and fro across the land by means of wire ropes, put into motion by a barrel or barrels caused to rotate by a steam-engine. By this arrangement, when the machine arrives at the end of its course in one direction, in place of having to turn it round, one set of implements descend and come into action, and this is effected by the draft of the wire rope taking place in the opposite direction." The ploughs being thus securely fixed on a see-saw frame, each end balancing the other, the draught had a tendency at the end it is pulling to drive the ploughs into the ground whilst it pulls out those at the other end. Mr. Bovill went on to say that, "What the defendants had done, was to adopt the light iron framing of Mr. Fowler's balance-plough. There was nothing, however, in this; but they had done more. In their arrangement they had put the ploughs at each end, on a separate axis, with separate levers; the set at one end operating to assist those at the other end, in the same manner as Messrs. Fiskin had originally done. So far they had taken Messrs. Fiskin's invention. The ploughs were drawn in the same way, by a rope attached to an anchor and passing round the drum of the engine which supplied the motive power. The two axes were connected together, just as Messrs. Fiskin's were—not, it is true, by the precise means, but by a mechanical equivalent which produced the same result. Messrs. Fiskin had an arrangement in the centre, by means of an eccentric movement, for throwing the preponderance of the leverage upon the ploughs that were to operate on the the ground. The defendants, Messrs. Howard, had also made a connection in the centre by means of two eccentric pulleys, over which a chain and rope passed, which produced the same effects. So that, in fact, it was substantially the same arrangement, and threw the preponderance of leverage on the ploughs that were in the ground exactly the same as Messrs. Fiskin's did. Now, if there were this preponderance, as in Messrs. Fiskin's invention, and as the defendants proposed in the specification of their patent, of course a greater power would have to be exerted to raise the ploughs out of the ground than if the ploughs were on a balance. Messrs. Howard very soon discovered that, and accordingly they adopted a plan to remedy it, which substantially made their plough the same in that respect as Mr. Fowler's. This they did by slightly altering the form of the eccentric pulleys and placing them in a particular position, by which arrangement, whilst professing to have their ploughs at each end of separate levers, they put them precisely on the same balance as Mr. Fowler's. Thus, the defendants first took Messrs. Fiskin's plan, of having two sets of ploughs, each on a separate axis; and, having done that, they next, by the chain or rope connected with the eccentric pulleys, joined them together, and made them like Mr. Fowler's." Mr. Bovill then gave an account of the arrangement entered into by Messrs. Howard with Mr. Fowler, for the use of his balance-plough and other patents; which arrangement, after trying to get the patent from Messrs. Fiskin, he (Mr. Howard) refused to carry out. The learned counsel stated,—That "failing to obtain the patent, he now turned round, and said to Mr. Fowler: 'I will put you to the expense of a trial, and try to upset both your's and Mr. Fiskin's patents.'" Mr. Hindmarch put in the different specifications of the balance-plough patents belonging to the plaintiffs, amongst which was a disclaimer filed by the present plaintiffs on the 20th December, 1862, with regard to Messrs. Fiskin's patent, disclaiming certain portions of the invention described in the specification. These portions of the specification are those relating to the way of transmitting the power to the ploughs.

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[*] We state the prices of these patents in case any of our readers may wish to have the original specifications; they may be obtained by enclosing the amounts, in stamps, to Mr. B. Woodcroft, patent commissioner, Southampton-buildings, Chancery-lane.

[*] We would advise Mr. Fowler to also disclaim that part of his patent, No. 1635, date 1856, claiming the "giving motion to a plough or other tilling instrument by means of two engines, each on a carriage with a single winding drum, mounted on a vertical axis, such engines traversing on the opposite headlands, and each working so as to draw the plough or other tilling instrument towards itself." He will find the same plan specified in patent No. 11,304, date 1846, by John Tulloh Osborn. A somewhat similar plan is also specified in patent No. 11,077, date 1846. The Marquis of Tweeddale also adopted a similar arrangement.

Mr. Hindmarch then examined Mr. Carpmael, who gave his evidence with great clearness and scientific precision. He stated that Messrs. Fiskin's ploughs counterbalance each other to a great extent. In allusion to the question of infringement, the witness described Messrs. Howard's plough as follows:—In this machine, at the end of a carriage on wheels there is a set of levers, each of which has applied to it, at the end, a set of ploughs. The two sets of levers are connected together, and to a common axis, by means of two pairs of chains which are fixed to eccentric levers, by which the two sets of levers, which formerly without those chains were not in a state of balance, and acting upon each other, are now by that means brought in such connection that the lifting, or rather the depression, of one set of ploughs into the land raises the other set, and the raising is assisted even by the descending ones. Therefore, upon this ploughing machine there are two sets of levers and two sets of ploughs, put into such connection that one assists the others in exchange of position.

On Monday, the 23rd of February, Mr. Carpmael was again examined by Mr. Hindmarch. He stated:—"The improvement upon Messrs. Fiskin's patent effected by Mr. Fowler, consisted in fixing the ploughs rigidly upon a frame instead of having them upon a swivel."

In the course of his evidence he further stated:—"I have compared the action of Mr. Howard's plough with that of Mr. Fowler's, and I find that there is no practical difference. It substantially comprises the essential properties of Fiskin's plough, with the addition of the essential properties of Fowler's."

In the course of a long cross-examination by Sir Fitzroy Kelly, this witness stated that the resemblance in point of principle between the defendants' ploughs and that of Messrs. Fiskin's was in the counterpoise, by which one set of ploughs was brought into the aid of the other in effecting a change of position. Sir Fitzroy Kelly examined Mr. Carpmael as to the resemblance between Messrs. Fiskin's plough and that of Campbell, patented in 1849, and described in Vol. 31, page 616, of the Mechanics' Magazine.

Campbell's plough evidently does not come under the designation of a balance-plough. Being further examined as to the difference between Messrs. Howard's and Fowler's plough, this witness said:—"In Fiskin's machine, when you come to the headland, you were obliged, by manual power, to lift the whole weight of the ploughs out of action to the highest position, or rather to a higher position than is necessary for the ploughs coming into action. Mr. Fowler raises the ploughs by the action of the rope, and brings down the other set upon the land. By continuing the pull they are brought into the land, the other set being lifted by the same action up to the highest position.

The real plaintiff in this action, Mr. John Fowler, jun., of 28, Cornhill, and of Leeds, was then examined by Mr. Aston. He stated that his intention was engaged from 1850 to 1853 on the drainage-plough, and since then, on to the present time, on steam-ploughs. He further stated that he was not aware that anyone had used the principle of counterpoise, as applied to a plough, before this was done by the Messrs. Fiskin. In allusion to his own plough, he stated that:—"The rigid fixing of the plough to the frame, and the dispensing with any intermediate basis by which it is not necessary that the power of the men should be injudiciously interfering with the action of the plough, is new in its application. By that I mean the dispensing with the screw-shaft and sector." He further stated that Messrs. Howard's and Messrs. Fiskin's ploughs resembled one another in the arrangement of two sets of ploughs on two sets of levers; the one set going out of action assisting by a counterpoise to raise the set going into action. The plough of the defendants is balanced in this way; the two chains being taken away, the plough would not balance at all; the two lever frames would be independent of each other in action. The two frames being attached to each other by eccentric levers, they are practically brought to a state of balance. Mr. Fowler further stated that he found in defendants' plough other improvements similar to those patented by himself and Mr. Greig—the fixing of the ploughs to a rigid frame, and the balancing of these ploughs over a central axis. Mr. Fowler stated that it had cost him almost £56,000 to perfect his invention up to the end of January, 1862. Being cross-examined, Mr. Fowler repeated the opinions we have quoted as to the novelty of the two patents in question.

On Tuesday Mr. G. Hinton Bovill was examined, and he stated in the course of his evidence that in the defendants' plough the machine is depressed by hand until it reaches the ground, then the draught-rope moves it into the land, and the end of the operation is the same as that which is accomplished by Fowler's plough by much more simple means. He further stated that the chain in Messrs. Howard's machine is a substitution for the slotted levers in Fiskin's plough.—Sir F. Kelly: The chain makes the frame rigid?—Mr. G. Hinton Bovill: Yes; and so far adopts the improvement of Mr. Fowler. The witness further stated that for all the practical purposes of a steam-plough, the levers are upon one frame, and in that respect there is no real or substantial difference between the plough of the defendant and that of the plaintiffs.

Mr. Allen Ransome, of Ipswich, was then examined, and in the course of his evidence he stated that he had paid £5,000 for a licence to make ploughs upon Mr. Fowler's patents.

Mr. Amos, the consulting engineer to the Royal Agricultural Society, was then questioned by Mr. Hindmarch for the plaintiffs. He stated that he concurred generally with the evidence already given.

Mr. Clayton, of the firm of Shuttleworth and Co., the eminent agricultural implement makers, was then examined by Mr. Bovill. He also stated that his firm had paid £5,000 to Mr. Fowler in pursuance to the agreement to which Messrs. Ransome, and Messrs. Burrell were also parties. It was then intended that Messrs. Howard should have taken part in this agreement; but they drew back at the last moment, and tried to enter into a separate arrangement with the Messrs. Fiskin. In the course of the correspondence that took place with Messrs. Fiskin, the defendants wrote:—"You cannot come upon Mr. Fowler or his licenses without you set aside the second agreement by a rule granted in a court of equity; nor can you deprive Mr. Fowler of his privileges without adopting this course, or the one you suggested of assisting to break down the patent." It is evident that Mr. Fowler was bound to commence these legal proceedings, regarding merely the interest of the firms who had adhered to the original agreement.

Sir F. Kelly, in addressing the jury for the defence, stated that he was not disposed to say that there was any ingenuity in Mr. Fowler's balance-plough. On the contrary, all the valuable points were taken from Messrs. Fiskins! To this we would reply in the well-known words of Milton:—

> "The invention all admired, and each how he
> To be th' inventor miss'd; so easy it seemed
> Once found, which yet unfound, most would have thought
> Impossible."

He further asserted that Mr. William Fiskin was "the true and first inventor," and that he had not given his formal consent when the patent was taken out, and no after consent given by him would be sufficient. "A patent was good or bad the moment it was taken out; and as at the time this patent was taken out William had not given his consent, the patent was invalid." This assertion was, however, completely disproved during the ensuing examination of Mr. William Fiskin, who stated that he merely communicated the idea of driving the plough by means of a fixed engine with an endless band, at a high speed. This witness also stated that he had no idea of having first communicated to his brother the idea of a balance-power, and that all the material parts, including the self-acting anchor, were the invention of his brothers.

Mr. Rogers, engineer and iron-founder of Stockton-on-Tees, deposed that he had invented the application of the segment-rack and endless-screw to the plough. As we mentioned before, he also claimed the invention of the self-moving anchor. He also stated that he had received £60, in 1857, to give up all interest in the patent.

Mr. James Howard, being called, gave *his* account of the agreement transaction. He also stated that in Fowler's plan, the ploughs were raised by the draught alone. In his a man was put on it.

Mr. Newton, examined by Mr. Webster for the defence, stated that in his opinion the draught in defendants' machine did not resemble that of Fowler's.

Mr. M'Connell gave a similar opinion, but on being cross-examined, stated that as the shares in Howard's plough fall in the ground they raise the others.

Mr. Pole, C.E., F.R.S., gave evidence in favour of the defence, but on cross-examination acknowledged that the connecting chain in Howard's plough would cause the counterpoise. This was the whole case for the defence.

In answer to the witness Rogers, Mr. Bovill examined Mr. Thomas Fiskin, who contradicted the assertion that Mr. Rogers had invented the self-acting anchor and the application of the screw and sector.

Mr. John Fowler (not a relation to the

plaintiff) stated that he had first introduced Mr. J. Fiskin to Mr. Rogers, and deposed to a conversation he had held with Mr. Fiskin before this introduction to Mr. Rogers, in the course of which the former described the balance-plough and self-acting anchor.

Sir F. Kelly then summed up for the defence. He mentioned, truly enough, that "the anchor described in the provisional specification was totally different from that described in the final specification." This certainly seems to to be the weakest part in the plaintiffs' case. He admitted that Messrs. Howard had adopted the principle of the counterpoise.

Mr. Bovill's reply was mainly a recapitulation of the previous evidence. In the course of his observations he alluded to the fact that Messrs. Howard, on the 15th of March, 1862, had made an agreement with the Messrs. Fiskin for the use of their patented inventions. These patents, however, having been made over to Mr. Fowler, the agreement was worthless; but the very first clause of that agreement was that Messrs. Fiskin should use their best endeavours to induce Mr. Fowler to grant a license to James Howard for the use of their inventions.

On Thursday morning, Lord Chief Justice Erle proceeded to make his charge to the jury. The learned Judge said that "the essence of Messrs. Fiskins' invention was the principle of counterpoise; the essence of Mr. Fowler's invention was an improved mode of applying that principle of counterpoise." The summing up was very justly in favour of Mr. Fowler. The Judge stated that there was no reason for supposing that in 1856 Mr. Howard had any notion of the improvements which he afterwards adopted. The jury having then retired, after a few moments returned into Court, and pronounced a verdict for the plaintiff on all the issues.

It is said that the Messrs. Howard will have the case tried over again in the Court above, before five of the Judges. They will probably base their appeal on the formal objections to the Fiskin patent, and further, on "the glorious uncertainty of the (patent) law." The defendants' plough is a scarcely colourable imitation, and a direct infringement of Messrs. Fiskin's and Fowler's patents. To this the defendants must plead guilty. The formal objections, however, to Messrs. Fiskin's patent appear to us to be very strong. A great portion of the patent has been already disclaimed, but nevertheless, the anchor is not described in the provisional specification, which latter ought not to differ from the final specification.

There cannot be much doubt as to the side on which right and justice are to be found. Unfortunately, law is not always justice, but rather a rough average struck between impracticable justice, and practical injustice. Mr. John Fowler, by his own ingenuity, capital, and undaunted perseverance, has conduced more than any other man to the present advanced state of the ploughing by steam. He has thus absolutely created the very interests that are now opposing him. It may be said that his own guns and shot are turned against himself, by the pirates who want to capture the ship he has built.

Let us hope that a liberal interpretation of the law will save any of Mr. Fowler's patents from being "broken down."

H.

FOULING OF IRON SHIPS' BOTTOMS.

We have often discussed this question, and must return to it. Like the member for Rochdale, we have no confidence in the Admiralty, which never moves out of the orbit of routine, or abandons its traditions except by compulsion. It never swerves from its accustomed obstructiveness, until it has undergone an incredible amount of badgering. On that principle we will again say a few words on the subject referred to.

The Secretary to the Admiralty has frequently brought the evil complained of under the notice of Parliament, but always, as it appeared to us, in a treacherous spirit, which, whilst it lamented in words the obstacle which the fouling of iron ships' bottoms opposed to the construction of a fleet of iron cruisers, seemed to exult in the chance which raised the obstruction, and turned a deaf ear to every rational suggestion for its removal.

Compositions without end have for years been tried and proposed and again tried, but never with anything like success, or indeed with any uniformity in the results. New compositions are being tried, and the noble Secretary somewhat facetiously informed the House that ships' bottoms were being enamelled.

We consider the success of any kind of preparation, in the form of a paint or unguent, problematical. Its effect can only be temporary. All experience has proved that to be the case. The most successful have to be renewed in a few months, and their action depends on the waters in which the ship lies, and the length of time she is in harbour. In many cases the preparation has corroded the iron plates. Whatever may be its nature, the mechanical or chemical effect of any substance, simple or compound, applied to the surface of the plate with the brush can only be of limited duration. The process of enamelling, by which we understand fixing a metallic or mineral material by the application of fire, and in a state of fusion, on the surface of iron plates, offers the hope of a successful result; and we think scientific experiment in carrying out that idea is taking a direction which may lead to useful discovery.

But other well-known methods of protecting iron ships from fouling exist, and have again and again been proposed to the Admiralty. Several of these have been examined and reported upon, but the issue has invariably been the consecrated formula, "their Lordships are not prepared to make a trial of the plan proposed."

Two or three plans of covering iron ships' bottoms with wood, and coppering them in the way employed for wooden ships, have been submitted to the Board. Amongst these, Mr. Grantham, a gentleman of scientific attainments, and thoroughly practical in his ideas, has repeatedly urged the expediency of giving his system a trial. It has been described and recommended in the Mechanics' Magazine. Models of it were exhibited in the International Exhibition, and no doubt were observed by many of our readers. Those models showed the practicability of the invention. Last session there seemed to be a chance of that or some other plan being put to the test. With much emphasis and the usual parade of the anxiety of Government to do justice to ingenious inventions, Lord Clarence Paget informed Parliament that a committee of scientific and practical men, of whom the member for Birkenhead was stated to be one, was appointed to examine and report upon plans for protecting iron ships from fouling. To give greater weight to this announcement, he mentioned that the only objection to the construction of the smaller classes of vessels employed as cruisers in distant stations, was the very difficulty in question. Hence the importance, he said, of finding a remedy.

Nevertheless, the project dropped still-born. It never to this day has been ascertained whether such a committee was appointed or not, or, if it was, whether it sat or examined any plan or ever reported.

This apathy, this indifference, to great national interests is disgraceful. The experiment to test the efficiency of any one of the plans proposed might be made for a few hundred pounds. The wood for the sheathing and the copper exist in the Government dockyards; the labour would be a small expense; and yet the Admiralty resolutely turns its face away from the very notion of so simple and easy a course.

We will not, however, be deterred from agitating this question, which, we hope, will be taken up earnestly in Parliament. To be consistent, those members who advocate an iron navy, should insist on Government devoting a sufficient sum to experiments on coppering iron ships. This appears to us the most rational mode of overcoming a difficulty, the existence of which is made a pretext for continuing the construction of wooden vessels.

Besides Mr. Grantham's system, there are others for effecting the desired object. Amongst them is one of merit, the invention of Mr. Charles W. Lancaster, on the principle of a coating of bitumen, insulating the copper from the iron. It offers some difficulties of execution, but these might be overcome by experience. The plan deserves a trial.

We have also had communicated to us a plan for affixing wood doubling to iron ships analogous to Mr. Grantham's, but which possesses the merit of being applicable to existing vessels, and could therefore be tried at a small expense. By means of dovetailed iron bars rivetted outside the ship's skin, and fitting into corresponding dovetailed slots in planks of wood, the latter are securely fastened to the bottom, and are ready to receive the copper sheathing. The main objection to any plan of this kind is the danger of a solution of copper, formed by the action of sea-water, saturating the wood and exercising its corrosive action on the iron plates. We think, however, that effect might be obviated by interposing an impervious material between the wood doubling and the iron skin; and we would suggest for that purpose a coating of Portland or other marine cement. Our reason for doing so is, that, about a year ago, when the "Ripon" was dismantled and the state of her hull examined, the brickwork at the bottom of her hold, which served as a foundation to the boilers, being removed, the plates underneath it were found in an extraordinary state of preservation. The iron appeared as sound and strong as when it was rivetted to the ship ten or twelve years before, the marks of the roller being visible upon the plates. An investigation into the cause of this remarkable fact, which was reported to the Admiralty, left no doubt that the cement in which the bricks were bedded was the preservative agent. There is no reason why a coating of cement should not be compressed between the planks of wood forming the doubling and the iron skin. The experiment is worth trying, and the more so because a stout doubling of three or four inch planks would greatly strengthen the iron bottom, and protect it from injury in the event of the vessel striking. This plan would remove the objection said to exist to navigating iron bottoms in shallow waters. The additional displacement resulting from the doubling would more than compensate the weight of the material employed in this system of coppering. The carrying capacity of the vessel would be rather increased than diminished. In recommending the House of Commons to urge upon Ministers experimental trials for the attainment of an object important to the public service, we offer these practical suggestions, in the hope they will have the effect of provoking discussion and inquiry.

IRON OR WOOD?

A STATEMENT has been presented to the Admiralty by Rear-Admiral Robinson, Controller of the Navy, on the relative advantages of iron and wood, and cost of these materials, in the construction of ships for Her Majesty's Navy. The Admiral says:—Taking it for granted that it is essential for this country to possess a number of ships armour-plated, equal to that of any other power, the first consideration must be with regard to such ships as we require, whether they shall be of wood or iron. There are two important points involved in this consideration. 1. The nature of the material. Iron possesses these advantages over wood:—An iron ship can be built of larger dimensions than a wooden ship, with no loss of strength. An iron ship has more rigidity and strength of structure, as a whole, than a wooden ship, though locally weak and liable to be penetrated by blows, which would fall harmlessly on a wooden ship. An iron ship has much greater durability in certain parts of the structure—indeed, in all parts where no wood is in contact with the iron—than a wooden ship; and after a lapse of years the iron frame would have suffered next to nothing as compared with a wooden ship. But against these advantages must be set the serious local weakness of the comparatively thin plates of which the bottom of an iron ship is necessarily composed; the danger, consequently, of getting on rocks in such ships; and the necessity which this weakness entails of constructing double bottoms, thwartship bulkheads, water-tight compartments, sluice-doors, &c., and various other complicated arrangements, which add both to the weight and cost of an iron ship; the rapidity with which the bottom of an iron ship gets foul, and the immense loss of all the ship's qualities that follows from the adhesion of marine zoophytes. No practical remedy has been found for this serious disadvantage; repeated docking and cleaning is the only palliative. Add to this the extreme uncertainty as to the quality of the material used—in fact, the small quantity of real good iron of the best shipbuilding qualities that can be found in the market; the prodigious ravages caused by the splinters of iron when the plates are broken and smashed by shot; and the far greater facility with which iron ships can be pierced below their armour plating by submarine guns than wooden ships. Lastly, as the progress that may be made by artillery and all destructive agents of warfare is quite without a limit, the immense price paid in an iron ship for durability may not be an advantage, as new forms for ships of war may, before long, be absolutely requisite. The iron ship of to-day, for which so large a price has been paid, may not be the weapon we require to-morrow. It may, therefore, be wiser and more economical to supply the wants of the moment by a cheaper and less durable structure, which at least is of the same quality as those with which we may have to contend. The most able designer of war-ships in Europe, whose success has been so remarkable, M. Dupuy de Lolme, is of this opinion, and constructs the ships that are to form the French line-of-battle of wood, in preference to iron. 2. The second point to be considered in this question is,—where and how the ships, whether of wood or iron, shall be constructed. If iron is the material preferred, we have the choice of either incurring a large outlay in our dockyards for the requisite plant, or of building by contract. In one dockyard only (Chatham) we can build in iron without any fresh expense. If, therefore, we take the other alternative, and build by contract, the following serious disadvantages attend upon our doing so. The first practical fact that comes before us is, that in no one instance have the contractors kept to their agreements with the Government, either as to time or cost. There is no prospect that more than one out of the four iron ships last ordered will be delivered till many months after the periods agreed upon. It is not one contractor or one iron shipbuilder, but all, who have failed in their agreements; and this clearly indicates the great uncertainty attending this mode of construction. Two other difficulties present themselves,—1. The general slovenliness of the work performed by iron shipbuilders, rendering the presence of an Admiralty Inspector necessary on the premises wherever the contract ships are building, and leading to many difficulties between the contractors and the Admiralty; and 2. The great temptations that beset the contractors, owing to the cost and difficulty of procuring good iron, to use inferior and cheaper material. Again, after a contract is signed, no alteration or improvement, however great, can be made without submitting to any terms the contractor chooses to enforce. Strikes of workmen, strikes of colliers, disputes in trades, all interfere with the progress of the work, and always to the prejudice of the Government. But, if wood be the material selected, the place of building will be our own dockyard, with all the plant, appliances, and materials already at hand. No more money will be required than what already appears in the Navy Estimates; whereas if the ships are built of iron by contract, the whole of the money required to do so must be voted separately, and in addition to the ordinary Navy Estimates; and the increase of the total charge to the country could only be diminished in a very small degree, if at all, by the discharge of a limited number of workmen from some of the yards, who in such a case are entitled to pensions or gratuities, for it would still be necessary to retain that large portion of workmen who are employed in repairs, fitting and refitting ships, and in building the smaller classes which are essential for the protection of our trade in the distant corners of the globe. In every way, therefore, the system of building by contract armour-plated iron ships would be more expensive than building armour-plated ships of wood in our dockyards. The wooden ship, though in some respects inferior in rigidity to the iron, and not quite so strong as a whole, is yet, if we may believe the detailed accounts we have received of such ships as the "Gloire," "Normandie," "Magenta," and "Solferino," perfectly sufficient for the weight it has to bear. Very bad weather has had no effect upon the "Gloire," a wooden ship plated from stem to stern, and therefore far more heavily loaded and more severely tried than any of our iron armour-plated ships have yet been; none of these ships having armour-plates at their extremities. Great addition to the strength of the wooden structures is given by iron beams, iron decks, filling in between the timbers, diagonal bracing, &c.; and, taking all the circumstances into consideration, it seems decidedly preferable, at the present time, to build these ships in our dockyards of wood rather than in private yards and of iron. As a comparison, the probable cost of the "Hector" and "Valiant," armour-plated ships, has been taken; though, being only partially armour-plated, and the accounts not yet completed, an addition must be made, to compare these with the wooden ships proposed to be built:—Cost of a ship of 4,063 tons, iron and partially armour-plated, if built by contract, £206,000; add (estimate), if wholly plated, £8,000—£214,000. Cost of a wooden ship of 4,200 tons, and of greater strength than those now building, wholly armour-plated, for wages and materials (estimated) £170,000; add, as in the case of private firms, for general charges incidental to the above, 10 per cent., £17,000—cost of the wooden ship built in the dockyard, £187,000. The cost of building the "Royal Oak," as furnished by the accountant of Chatham dockyard, for labour and materials, with 2 per cent. added, is £151,970, including the value of materials already provided before the conversion commenced; adding to this 10 per cent. for general charges, as a private builder would do, the cost of the "Royal Oak" for building amounts to about £168,000, subject to any corrections arising from the auditing the accounts when they are completed. The time required to build the iron ship by contract has been 25 months (in the case of the "Hector"). To build the wooden ship leisurely and to the best advantage would take about as long; but if as much pressed as the contractors have been for the "Hector," and if the workmen were entirely uninterrupted, the period might be shortened to 21 months.

AMERICAN INVENTIONS.

AT a recent meeting of the Franklin Institute, Philadelphia, Mr. Howson exhibited a large number of locks, not, as he said, because there was anything essentially new in most of those exhibited, but in order to show the great number of devices which had been produced in order to make locks that would answer for either right or left-handed doors. Mr. H. also exhibited an improved burner for coal oil lamps, invented by Emil Tritten. The wick tube is so isolated, that although it is firmly attached to the burner, the heat from the flame cannot be conveyed to the reservoir so as to vaporize, and thus waste the oil. An extremely simple and ingenious burner for coal oil lamps, the invention of W. O. B. Merrill, of this city, was also exhibited.

B. F. Joslyn's improved revolving pistol for metallic cartridges was exhibited by Mr. H. The cylinder of the pistol, on withdrawing the centre pin, may be pushed to one side without entirely detaching it from the frame. The advantage of this is that the pistol may be loaded and the spent cases removed without any liability of losing the cylinder by detaching it. The centre pin passes through a key so connected to the front of the frame that it may also be turned to the side, and the pin pushed back through the openings in the cylinder, thereby forcing out the cases of the discharged cartridges.

A belt fastener, invented by Messrs. Leibrich and Uitting, of that city, was exhibited. Two eccentric rollers, the surfaces of which are so formed as to present a series of longitudinal ribs having sharp edges, are connected together at the ends by metal plates, in which the journals of the rollers turn. When the surfaces of the rollers are farthest apart, the ends of the strap or belt may be passed upwards between them. On attempting to withdraw the strap, however, the rollers are turned, and the surfaces brought nearer together, securing between them the ends of the belt, which are prevented from slipping out by the sharp edges, or ribs, on the rollers, which hold the ends together with a grip increasing with the force applied to withdraw the ends of the strap.

A combined rule, square, and level, was exhibited by Mr. Howson. The frame of the rule is of metal filled with vulcanized rubber, which forms in the present instance the body of the instrument, although other substances may be used. By means of a strip of metal, jointed, and contained within the rule, and a spirit-level in a recess in the edge of the same, a number of operations, each heretofore requiring a separate instrument, may be performed.

G. F. Witsel's patent combined washing-machine and clothes-wringer was exhibited. In a triangular reservoir vibrates a similarly-shaped dasher, which is so constructed as to form a receptacle for the clothes, which, as the dasher is vibrated, are cleaned by the water which passes through openings in the sides of the dasher, and through the interstices of the clothes. The journals of two rubber-covered rollers turn in the opposite sides of the reservoir, and are so situated that the clothes may be taken from the dasher, and passed directly between the rollers.

Mr. T. J. Weygandt exhibited a thermo-multiplier, an extremely neat and sensitive instrument, made by himself. The chief merit consists in the compactness, the whole of the essential parts occupying a space but little larger than two cubic inches. Mr. W. stated that a fly on the bars would deflect the needle from three to five degrees.

ZERAH COLBURN'S STEAM PUMPING ENGINES.

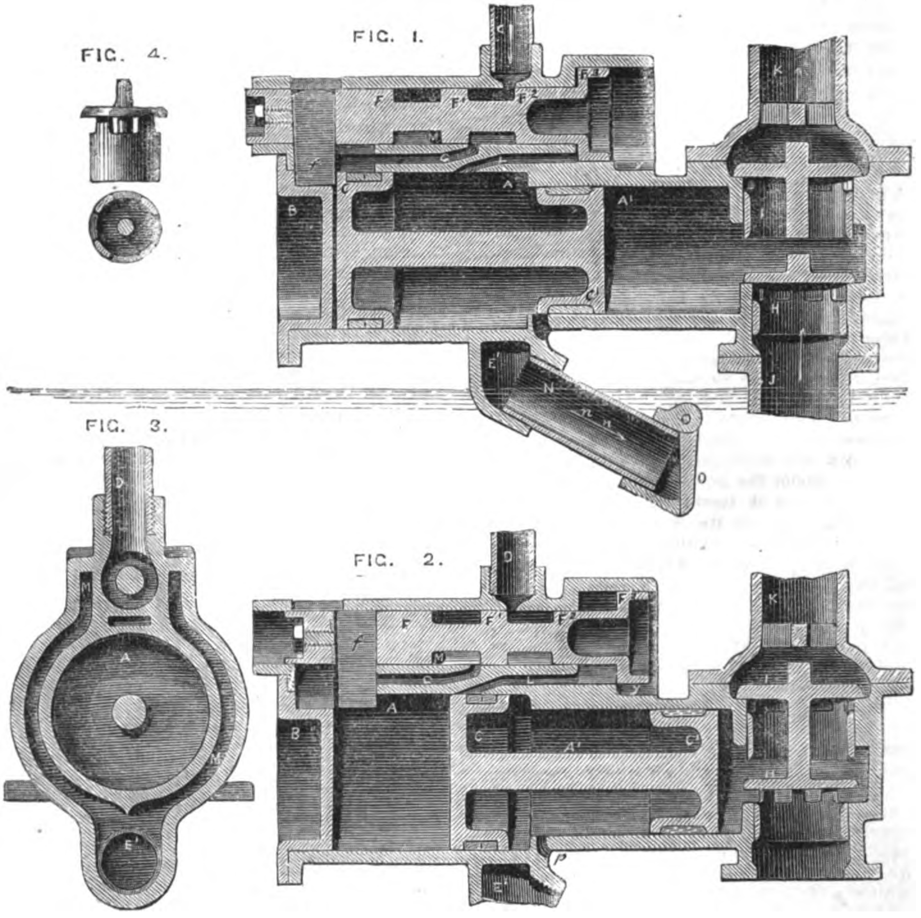


FIG. 1.
FIG. 2.
FIG. 3.
FIG. 4.

COLBURN'S STEAM PUMPING ENGINES.

A VERY neat and compact arrangement of steam pumping engine has lately been patented by Mr. Zerah Colburn, of 15, Tavistock-street, Bedford-square.

The steam cylinder and pump barrel are so constructed that they shall form but a single vessel closed at both ends. Within this vessel is placed either a single long piston or two pistons cast, forged, or otherwise firmly joined together, and the distance between the two outer faces of the long piston or of the double piston, as the case may be, is made sufficiently great in proportion to the stroke to prevent the exposure of any single point in the cylinder or pump-barrel to the alternate action of steam and of the water being pumped. Thus for a stroke of 12 in., the total length of the single or double piston is at least 15 in., and, by preference, 20 in. That part of the vessel which serves as the pump-barrel, may be of the same diameter as, or of less or greater diameter than, the part which serves as the steam cylinder, according to the pressure of steam to be used, and according to the height to which the water is to be pumped. When steam is admitted to the steam end of the vessel, the piston is pressed against the water in the opposite or water end, and the piston will make a stroke. Before the stroke is quite completed, the piston is caused to open a valve either directly or through suitable mechanism, and by this valve the steam in the cylinder is discharged into a condenser, so as to leave a vacuum in the cylinder. The pressure of the atmosphere upon the water in the pond, stream, reservoir, or other place from which the water is being pumped will then be exerted, so as to open the lower valve of the pump, and thus cause a pressure upon the water face of the piston so as to force the piston in a direction opposite to that in which it had been previously impelled by the steam. By re-admitting steam and condensing, in the manner hereinbefore described, any number of strokes may be made in succession. In cases where the steam pumping engine is employed in near contiguity to an ordinary condensing steam engine the exhaust steam from the steam pumping engine may be turned into the condenser of the other engine; but where such an opportunity does not occur, the patentee employs in connection with the steam pumping engine a condenser of a kind described in Doctor Ernest Alban's Treatise on the high-pressure engine. The exhaust steam pipe has a flap valve on its outer end, which end is kept constantly immersed in water. One or more small holes are also made in the exhaust steam pipe for the admission of injection water. At every discharge of exhaust steam the exhaust steam pipe is blown through, and the flap valve is opened by the pressure of the steam; but as soon as this pressure falls to that of the atmosphere the flap valve closes, and the injection water coming in through the openings in the pipe condenses the steam and forms a vacuum. The valves of the steam pumping engine, that is to say, those regulating the flow of the steam, are, by preference, of the kind known as piston valves, and are moved by the direct pressure of steam upon them; the steam for this purpose being controlled by a supplementary piston valve worked by the main piston or pistons in the steam and water cylinder. Two of the pumping engines herein described may be made to work alternately, so as to throw a continuous stream.

The obvious effect of these improvements, is to greatly simplify the construction of steam pumping engines, by dispensing with the parts required for or with rotary motion, and dispensing also with counterweights, stuffing boxes, and the more complex combinations of valve gear. It is, indeed, practicable, to construct a complete and useful steam-pumping engine, which, when ready for fixing and for the attachment of the steam and water pipes, shall have but five pieces of metal of any kind, and of which five pieces but two shall have motion.

Compactness is also secured to an extent not before attained, and there is the utmost certainty of action. The pump will work in any position to which the steam valves and water valves may have been made to conform; whereas, Cornish engines, or those in which a weight is attached directly to the pump pole, can only act vertically. This steam pumping engine will work, moreover, without special adjustment to the "lift" at any lift of water for which a corresponding pressure of steam is first provided.

The several figures represent one form of the single-acting steam pumping engine. Fig. 1 is a longitudinal section, showing the steam piston and plunger at the commencement of the steam stroke, or forcing stroke, and the steam valve in position for admitting steam for such stroke. Fig. 2 is a like longitudinal section, differing from fig. 1 only in showing the steam piston and plunger near the end of the steam stroke, or forcing stroke, and the steam valve in position for permitting the steam to be exhausted from the cylinder, and condensed; and fig. 3 is a cross section taken through the steam cylinder in the vertical plane of the inlet steam pipe and exhaust steam belt; and fig. 4 shows the water valves used.

A, A, A, A¹, represent a vessel, of which the portion A, A, forms a steam cylinder and the portion A¹, A¹, forms a water barrel or pump barrel. The portion of this vessel answering the purpose of the steam cylinder being in this case of larger diameter than that serving as the pump barrel, the end of the steam cylinder is left open in casting, and a cover B is fastened by bolts or otherwise, so as to tightly close the end of the cylinder. A double-ended piston C, C¹, one end C of which is intended to receive the pressure of the steam in A, A, and the other end C¹, of which is intended to work against the water in A₁, A¹, is fitted by means of suitable packing, of any well-known kind, so as to be steam and water tight, into the vessel A, A, A¹, A¹. Steam for forcing the piston C, C¹, is admitted in the first instance through the pipe D, and thence passes into so much of the interior space of the hollow cylindrical valve chamber E as is included between the pistons or bosses F¹, F², of the piston valve F, F¹, F², F³. In fig. 2, it will be seen that the part of the piston valve between the bosses F₁ and F² forms a communication between the steam pipe D and the port G, leading to the steam end of the vessel A, A, A¹, A¹, and in this position of the piston valve F, F¹, F², F₃, steam will be admitted upon the steam end C of the double-ended piston C, C¹, which will thus be propelled towards the right hand, and thus make a steam stroke or forcing stroke. At the right-hand end of figs. 2 and 3 respectively are shown the pump valves H and I, and which do not or need not differ in principle from those in general use in force pumps. The water rises through the pipe J, and through the lower valve or suction valve H, and is afterwards forced through the valve I and pipe K to any point to which the pump is made to force.

The water valves H and I are more clearly shown by fig. 3, where it will be more plainly seen that the water passes upward through hollow cylindrical guides formed on the lower sides of the valves, the water escaping, as the valves lift, through apertures cut out of the hollow cylindrical guides, and just below the seats of the valves. It will be seen that the upper valve I is made so much larger than the lower valve H, that when the pipe K is removed and the valve I taken away, the valve H may be lifted out through the seating of the valve I. It will also be seen that the stop to prevent the lower valve H lifting too high is formed as a stalk on the valve I.

With this description of the water valves, we will return to the double-ended piston C, C₁. When this has been forced by the steam to a sufficient distance, the steam end C will uncover an opening or port L, through which steam will then pass from A, A, to press upon the annular face F³ of the piston valve F, F₁, F², F³. By the pressure of the steam thus exerted, this piston valve will be moved into the position shown in fig. 2. In this position the valve F, F^1, F^2, F^3, will have shut off the steam from the pipe D to the port G, and placed that port in communication with the exhaust port M, of which, indeed, there are two, one of which opens from each side of the valve chamber E, extending thence half around the vessel A, A, as shown in fig. 4, and meeting at E^1 at the lower part of A, A. The steam previously admitted to the cylinder will now be exhausted through M, M, and by E^1 into the pipe N. This pipe, although for convenience of drawing it, has not been shown to have a length which would give it a capacity about equal to the steam end A, A, of the vessel A, A, A^1, A^1, should, nevertheless, have a capacity about equal to so much of that vessel as serves the purpose of a steam cylinder. The lower end of the pipe N should be under water, and the lower end of the pipe N should be furthermore fitted with a hinged or flap valve O, or other freely-moving valve permitting the ready escape of the exhaust steam into the water. One or more holes *n*, *n*, are also made in the pipe N at some little distance under the surface of the water, in which its lower end is immersed. Now, when the steam, after doing its work, escapes from the steam end or steam cylinder of the vessel A, A, A^1, A^1, it, the steam, will follow the passages M, M, and enter the pipe N. As the pressure of the steam will at first be considerably greater than that of the atmosphere and of the water acting to close the hinged valve O, that valve will be blown open, the pipe N will be blown through, so as to clear it of any air it may contain, and the greater part of the steam will then be condensed in the water into which it is discharged. At the moment, however, when the pressure of the steam in the pipe N has fallen to the pressure of the atmosphere, the valve O, will be free to close, and as it does so a small quantity of water will enter by the openings *n*, *n*, and thus condense the steam, of a pressure equal to the atmospheric pressure, then remaining in the pipe N. A nearly perfect vacuum will thus be produced in the pipe N, passages M, M, port G, and in the steam end of the vessel A, A, A^1, A^1. The piston C, C^1, having now a vacuum on its steam side, will recede into the vacuous space by virtue of the pressure of the atmosphere, acting in one or both of the following manners:—The pressure of the atmosphere acting on the surface of the water from which the engine is pumping will force up the valve H, as shown in fig. 3, and thus fill the water end or pump barrel of the vessel A, A, A^1, A^1, forcing back the piston or pistons C, C^1, at the same time; or inasmuch as in the case of the particular pumping engine shown, the steam end C of the double-ended piston C, C^1, has a larger area than C^1, and as the air has always free access through the opening *p* to the space between the piston ends C, C^1, the air acting upon the excess of area which C has as compared with C^1, may force the pistons back before the water has time to enter sufficiently to transmit the atmospheric pressure to the surface of C^1. In either case the return stroke of the double-ended piston C, C^1, will have been effected by atmospheric pressure only. The steam previously admitted upon the annular face of the boss F^3 of the piston valve F, F^1, F^2, F^3, will have already escaped through the channel *v*, and therefore when the double-ended piston C, C^1, has returned sufficiently far to strike the arm or cotter *f* projecting from the piston valve, the latter will be moved thereby into its original position, as shown in fig. 2, and in which position another steam stroke will commence. It is to be understood that the arm or cotter *f* is to be so fitted as to allow of no escape of steam.

MERITON'S SPEED REGULATORS.

These improvements in steam engine governors and speed regulators for machinery, recently patented by Mr. T. Meriton, of Hamburg, relate to that description of governor known as the fly wheel governor, the action of which depends upon what may be termed the principle of differential velocities. The improvements consist partly in simplifying this form of governor by dispensing with superfluous parts, thereby effecting economy in first cost, but mainly in rendering more certain, prompt, and efficient its action by improved construction, arrangement, and disposition of parts. A shaft, made wholly or partially hollow, is cut through at portions of its surface so as to form two spiral guides or double-action inclines. Upon this hollow shaft is fitted loosely a fly wheel having at the hub or boss an elongated cylindrical piece or chamber, with guides cut spirally through its surface so as to form double-action inclines. In the interior of the hollow shaft before mentioned is a short spindle or shaft attached to a lever for working the valve. This short spindle or shaft has a pin passing through it in such a manner that the ends project and form as it were two studs, which fit into recesses or holes cut through, or in the inner surface of a ring, which ring has also forged upon its outer surface two studs. The two pin ends or studs within the circle of the ring pass through the spiral guides of the hollow shaft from the short shaft connected with the lever working the valve, and the two studs, without the circle of the ring, pass into the spiral guides in the cylindrical piece or chamber attached to or forming part of the fly wheel.

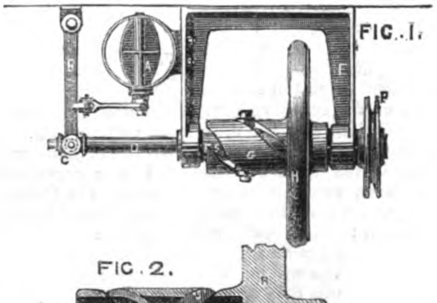
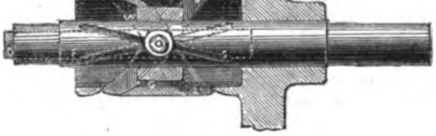


FIG. 1.

FIG. 2.

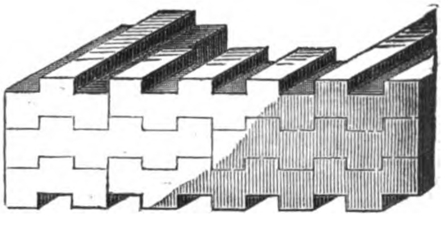


In these engravings the governor is suspended by hangers to a deck beam of the vessel. Fig. 1 is a sectional elevation; fig. 2 is a separate view on an enlarged scale of the hollow shaft and cylindrical piece, for the purpose of showing more clearly the arrangement of spiral guides or double-action inclines. F, F, is the hollow or partially hollow shaft; and S, S are the spiral guides or double-action inclines cut therein; H is the fly wheel with cylindrical piece or chamber G, having also spiral guides or double-action inclines; D is the short spindle or shaft working in interior of hollow shaft, and having a pin passing through its end and through the hollow shaft, and taking into the ring, W, which has two studs, K, K, on its outer surface passing into the guides, in cylindrical piece or chamber attached to or forming part of fly or momentum wheel. These studs may be forged on to the ring, W, so as to form one piece therewith, or they may be screwed; E, E, are the bearers or hangers; A the throttle valve, and B, C, the hinged lever arrangement for communicating the travel of the sliding ring, W, to the valve; P is a pulley for the purpose of driving the shaft, F, by connection with the motive machinery which is to be regulated. This arrangement of regulating apparatus is connected either by pulleys or gearing with the engine, and upon any increase of engine speed, the speed of the hollow shaft, F, will be in excess of that of the fly wheel, H, and the inertia of the wheel, resisting at first the change, will cause the one set of inclines, S, to press upon the studs and draw up the ring, and also the short shaft, D, connected with the valve, A, whereby the valve will be closed. Thereupon the engine speed, and consequently that of the hollow shaft, will fall below that of the fly wheel, H, which will cause the second set of inclines to press upon the studs and return the ring, and also the short shaft to their original positions, thereby reopening the valve without the aid of a spring or a weight, as employed in most governors of this description. It will be seen also that the use of any sliding sleeve is dispensed with. This arrangement, although designed principally for marine engines, is applicable to all kinds of steam and other motive power engines and machinery requiring a controlling or regulating apparatus.

BELL'S PATENT BRICK.

Mr. R. Bell, of Westland-row, Dublin, has obtained a patent for a brick so formed as to bind the work in such manner that it shall form a mass incapable of being riven asunder. These bricks are well adapted for arches, tunnels, and vaults, by forming them of a wedge-like shape, the grooves and tongues corresponding accordingly. The bricks are also suitable for fortifications, embankments, sewers, lighthouses, and for general building purposes.

The bricks are formed with projections or tongues across or along one surface, and with grooves or recesses of corresponding size on the opposite side, whereby they may be laid down one on the other, with the aid of a small quantity of mortar or cement, in such order as to fit or bind together the upper layer with the lower layer, and to tie each other longitudinally and crosswise so as to prevent any lateral or transverse deviation or fissure occurring in the work. The engraving annexed clearly illustrates the shape of the proposed brick.



With regard to bricks for arches a similar system of construction is adopted by means of which it is evident that centres will not be required in the construction of arches and vaults, for as soon as one single layer of bricks has been thrown across the arch the series may be continued by inserting the second layer into the first, into which it will register and be self-supporting, and so on with the entire length of arch, tunnel, or vault. By the adoption of this invention a wall or arch may be constructed with great rapidity and with much greater strength, durability, and saving of expense than by the use of the bricks now in use.

INSTITUTION OF CIVIL ENGINEERS.

March 3, 1863.

C. H. Gregory, Esq., Vice-President,
in the Chair.

The paper read was on "The Perennial and Flood Waters of the Upper Thames," by the Rev. J. C. Clutterbuck, M.A.

The object of this communication was to draw attention to the nature of that portion of the watershed of the Thames comprising the oolitic district, and containing a computed area of 1,500 square miles, situated between the range of chalk hills bounding the vales of Aylesbury and of White Horse, and the Cotswold hills bounding the Vale of Evesham and the Valley of the Severn. It was shown that the Thames ran almost entirely over a clay bed from its source, about four miles west of Cirencester, to its junction with the Thame stream, the limit of the district under consideration; and that it was the mere carrier of waters, whether perennial or flood, brought in by its tributaries, a description of which, in the order they joined the main river, was given. Those running from N. to S. and from N.W. to S.E.—as the Churn, the Coln, the Leach, the Windrush, the Evenlode, and the Cherwell—received their perennial waters from oolitic strata.

Those flowing from S. to N. originated in the chalk hills from the escarpment of which they conveyed the back drainage, slightly augmented by that of the upper greensand, and then passed over the gault and kimmeridge clays, either to the main stream, as the Ray and the Cole, or as the affluents of the Ock and the Thame, from which the principal supply was derived.

The geological condition of the source of the main stream was next noticed; and it was stated that the whole natural bed of the river, from Somerford Keynes to Sandford, below Oxford, was an excavation in the Oxford clay, flanked to the south by the escarpment of the coralline oolite, which rested on a ridge of the clay. As a rule, the lower levels of the valley, including also in many places the oolitic rock, outcropping to the north at a very slight angle beneath the Oxford clay, were covered with drift gravel. Wherever the floods had extended, sand, silt, or argillaceous loam had been deposited on this gravel; and this action was still going on, governed by the number and character of the floods. Thus, the bed of the river was, as a rule, gravel, and the banks a warp, the accumulation of ages. There were instances of the change of bed to the extent of several chains in width; and indeed there appeared to be no limit to these deviations but the physical features of the valley. These facts had an important bearing on any improvement, so much needed, in the drainage or condition of the Thames valley.

The perennial waters are either used for mills, or for navigation. The mills on the tributaries were numerous. Between Thames Head and Cricklade they were, however, virtually deprived of water. From Cricklade to Lechlade the water was not applied to any economical use; and again from Lechlade to Wolvercote, three miles above Oxford, there were no mills. The gaugings of the numerous tributaries, where they joined the main stream, would give the aggregate of the water that it carried; but such observations had been neglected, and as the watersheds were very varied, any estimate of the volume of these streams at different seasons would be difficult. Most of these tributaries were immediately affected by heavy rains, and were subject to flood. The gauging of the main stream was beset with other difficulties; as the height and passage of the water was divided between the mills and the navigation, controlled, indeed, by stringent regulations, but too often disregarded. Though it was not the purpose of this communication to deal with absolute quantities derived from the various sources, yet it was believed the following gaugings, the result of several years' observations by Mr. Stacy, the manager of the mills at Wolvercote, would be received with interest, and would, if carried out in other places, lead to valuable results. There were no mills for thirty miles above Wolvercote, and the navigation, though "flashes" were still sent down, had virtually ceased. Mr. Stacy had found that, in the summer months, the river had a mean velocity of 50 ft. per minute, when the total yield was 8,120 cubic feet per minute, exclusive of the quantity brought down twice a week by "flashes," which it was difficult to estimate. During the winter months, in fine weather, without frost or rain, the river had a mean velocity of 94·9 ft. per minute, and taking the sectional area as 181·5 square feet, this gave a volume of 17,224 cubic feet per minute. In moderate rainy weather, without floods, when the level of the river just reached the high water navigation mark, the total quantity of water passing through the mill was 28,189 cubic feet per minute.

At the end of December, 1862, under similar conditions, the total yield was 35,498 cubic feet per minute, of which 7,738 cubic feet might be taken as the water passing from the main stream to Wytham. These data suggested the necessity of adopting a standard at various stations, so that the results might be compared with the rainfall when the gaugings were taken. At the same time observations were made on the river below the influx of the Cherwell and the Ock, when the yield was found to be 50,995 cubic feet per minute, being an excess of 15,497 cubic feet as compared with Wolvercote, and of which excess it was estimated that 7,689 cubic feet were brought in by the Cherwell, and the remainder by the Ock and the smaller perennial streams. The verification of these quantities was prevented by a fall of rain of nearly half an inch in a few hours, which, at an expiration of 36 hours, doubled the volume of the Thame stream, and added about 30 per cent. to the volume of the main river. At Wolvercote, on the 5th January, 1863, after about one inch of rain, the increase was from 27,986 to 48,418 cubic feet per minute. The rainfall from the 1st to the 7th January, 1863, inclusive, produced a flood in the Thames under circumstances peculiarly favourable for observation. The rain recorded during this period averaged 1·61 in. over the whole water-shed, Dalton's gauge, at Hemel Hempstead, showing a fall of 1·52 in., and a percolation of 1·10 in. The gaugings of the main river at Wolvercote then amounted to 82,500 cubic feet per minute, and at Clifton Hampden, below Abingdon, to 181,832 cubic feet per minute. Of this latter quantity 44,755 cubic feet were delivered by the Cherwell (or an increase of 37,066 cubic feet as due to the flood), 24,864 cubic feet by the Ock, and 29,713 cubic feet by the many smaller streams, water-courses, and land drainage outfalls issuing into the river between Wolvercote and Clifton Hampden, a distance of about twenty miles by the river, with an average fall of 2 ft. per mile, from a computed watershed of eighty square miles. It should be stated that the rainfall on this occasion, on the southern part of the district, was in excess of the average more than half an inch.

The state of navigation between Lechlade and Oxford was then described. It was remarked that from running on one stratum, the Oxford clay, and from other causes, it had ceased to be; although the physical condition of the river bed, and its easy gradients, offered facilities for navigation, for the whole fall in this distance, thirty-one miles, was only 51 ft. 3 in., or about 1 ft. 7½ in. on an average per mile.

The highest recorded floods on the Thames since January 8, 1734, were then alluded to, and details were given of that which occurred March 29-31, 1862. The action of land drainage on flood water was next considered. It was generally admitted that the floods in the main river and its tributaries rose more rapidly than formerly, there being in some localities an advance of 24 in 72 hours within the last 20 years. There was a difference of opinion as to subsidence of the water. As yet, however, it was believed that land drainage had produced little apparent practical effect on the volume of the flood, or perennial waters of the Upper Thames.

There was great scope for improvement in the valleys of the Thames and its tributaries, especially the Thame, the Ock, the Cherwell, and the Evenlode. With a view to prevent injury by floods, Mr. Bryan Wood had successfully carried out several important works, based on a system in which the local drainage was separated from the flood. If by some such plan the floods were brought under control, and the water prevented from remaining stagnant on the land, property would be improved, and the sanitary condition of the Valley of the Upper Thames would be benefited.

ON RADIATION THROUGH THE EARTH'S ATMOSPHERE.*

NOBODY ever obtained the idea of a line from Euclid's definition, that it is length without breadth. The idea is obtained from a real physical line drawn by a pen or pencil, and therefore possessing width; the idea being afterwards brought, by a process of abstraction, more nearly into accordance with the conditions of the definition. So also with regard to physical phenomena; we must help ourselves to a conception of the invisible by means of proper images derived from the visible, afterwards purifying our conceptions to the needful extent. Definiteness of conception, even though at some expense to delicacy, is of the greatest utility in dealing with physical phenomena. Indeed, it may be questioned whether a mind trained in physical research, can at all enjoy peace, without having made clear to itself some possible way of conceiving of those operations which lie beyond the boundaries of sense, and in which sensible phenomena originate.

When we speak of radiation through the atmosphere, we ought to be able to affix definite physical ideas, both to the term atmosphere and the term radiation. It is well known that our atmosphere is mainly composed of the two elements, oxygen and nitrogen. These elementary atoms may be figured as small spheres scattered thickly in the space which immediately surrounds the earth. They constitute about 99½ per cent. of the atmosphere. Mixed with these atoms we have others of a totally different character; we have the molecules, or atomic groups, of carbonic acid, of ammonia, and of aqueous vapour. In these substances diverse atoms have coalesced to form little systems of atoms. The molecule of aqueous vapour, for example, consists of two atoms of hydrogen united to one of oxygen; and they mingle as little triads among the monads of oxygen and nitrogen, which constitute the great mass of the atmosphere.

These atoms ond molecules are separate, but in what sense? They are separate from each other in the sense in which the individual fishes of a shoal are separate. The shoal of fish is embraced by a common medium, which connects the different members of the shoal, and renders intercommunication between them possible. A medium also embraces our atoms; within our atmosphere exists a second, and a finer atmosphere, in which the atoms of oxygen and nitrogen hang like suspended grains. This finer atmosphere unites not only atom with atom, but star with star; and the light of all suns, and of all stars, is, in reality, a kind of music propagated through this instellar air. This image must be seized, and then we have to advance a step. We must not only figure our atoms suspended in this medium, but we must figure them vibrating in it. In this motion of the atoms consists what we call their heat. "What is heat in us," as Locke has perfectly expressed it, "is, in the body heated, nothing but motion." Well, we must figure this motion communicated to the medium in which the atoms swing, and sent in ripples through it with inconceivable velocity to the bounds of space. Motion, in this form, unconnected with ordinary matter, but speeding through the instellar medium, receives the name of radiant heat; and, if competent to excite the nerves of vision, we call it light.

Aqueous vapour was defined to be an invisible gas. Vapour was permitted to issue horizontally, with considerable force, from a tube connected with a small boiler. The track of the cloud of condensed steam was vividly illuminated by the electric light. What was seen, however, was not vapour, but vapour condensed to water. Beyond the visible end of the jet the cloud resolved itself into true vapour. A lamp was placed under the jet at various points; the cloud was cut sharply off at that point, and when the flame was placed near the efflux orifice the cloud entirely disappeared. The heat of the lamp completely prevented precipitation. This same vapour was condensed and congealed on the surface of a vessel containing a freezing mixture, from which it was scraped in quantities sufficient to form a small snowball. The beam of the electric lamp, moreover, was sent through a large receiver placed on an air-pump. A single stroke of the pump caused the precipitation of the aqueous vapour within, which became beautifully illuminated by the beam; while, upon a screen behind, a richly-coloured halo, due to diffraction by the little cloud within the receiver, flashed forth.

The waves of heat speed from our earth through our atmosphere towards space. These waves dash in their passage against the atoms of oxygen and nitrogen, and against the molecules of aqueous vapour. Thinly scattered as these latter are, we might naturally think meanly of them as barriers to the waves of heat. We might imagine that the wide spaces between the vapour molecules would be an open door for the passage of the undulations; and that if those waves were at all intercepted, it would be by the substances which form 99½ per cent. of the whole atmosphere. Three or four years ago, however, it was found by the speaker that this small modicum of aqueous vapour intercepted fifteen times the quantity of heat stopped by the whole of the air in which it was diffused. It was afterwards found that the dry air then experimented with was not perfectly pure, and that the purer the air became the more it approached the character of a vacuum, and the greater, by comparison, became the action of the aqueous vapour. The vapour was found to act with 30, 40, 50, 60, 70 times the energy of the air in which it was diffused; and no doubt was entertained that the aqueous vapour of the air which filled the Royal Institution theatre, during the delivery of the discourse, absorbed 90 or 100 times the quantity of radiant heat which was absorbed by the main body of the air of the room.

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* Read before the Royal Institution, Jan. 23, 1863, by Professor Tyndall, F.R.S.

Looking at the single atoms, for every 200 of oxygen and nitrogen there is about 1 of aqueous vapour. This 1, then, is 80 times more powerful than the 200; and hence, comparing a single atom of oxygen or nitrogen with a single atom of aqueous vapour, we may infer that the action of the latter is 16,000 that of the former. This was a very astonishing result, and it naturally excited opposition, based on the philosophic reluctance to accept a result so grave in consequences before testing it to the uttermost. From such opposition a discovery, if it be worth the name, emerges with its fibre strengthened; as the human character gathers force from the healthy antagonisms of active life. It was urged, that the result was on the face of it improbable; that there were, moreover, many ways of accounting for it, without ascribing so enormous a comparative action to aqueous vapour. For example, the cylinder which contained the air in which these experiments were made was stopped at its ends by plates of rocksalt, on account of their transparency to radiant heat. Rocksalt is hygroscopic; it attracts the moisture of the atmosphere. Thus, a layer of brine readily forms on the surface of a plate of rocksalt; and it is well known that brine is very impervious to the rays of heat. Illuminating a polished plate of salt by the electric lamp, and casting, by means of a lens, a magnified image of the plate upon a screen, the speaker breathed through a tube for a moment on the salt; brilliant colours of thin plates (soap bubble colours) flashed forth immediately upon the screen—these being caused by the film of moisture which overspread the salt. Such a film, it was contended, is formed when undried air is sent into the cylinder; it was, therefore, the absorption of a layer of brine which was measured, instead of the absorption of aqueous vapour.

This objection was met in two ways. Firstly, by showing that the plates of salt, when subjected to the strictest examination, show no trace of a film of moisture. Secondly, by abolishing the plates of salt altogether, and obtaining the same results in a cylinder open at both ends.

It was next surmised, that the effect was due to the impurity of the London air, and the suspended carbon particles were pointed to as the cause of the opacity to radiant heat. This objection was met by bringing air from Hyde-park, Hampstead-heath, Primrose-hill, Epsom-downs, a field near Newport, in the Isle of Wight, St. Catherine's Down, and the sea-beach near Black Gang Chine. The aqueous vapour of the air from these localities intercepted at least seventy times the amount of radiant heat absorbed by the air in which the vapour was diffused. Experiments made with smoky air proved that the suspended smoke of the atmosphere of West-London, even when an east wind pours over it the smoke of the city, exerts only a fraction of the destructive powers exercised by the transparent and impalpable aqueous vapour diffused in the air.

The cylinder which contained the air through which the calorific rays passed was polished within, and the rays which struck the interior surface were reflected from it to the thermo-electric pile which measured the radiation. The following objection was raised:—You permit moist air to enter your cylinder; a portion of this moisture is condensed as a liquid film upon the interior surface of your tube; its reflective power is thereby diminished; less heat therefore reaches the pile, and you incorrectly ascribe to the absorption of aqueous vapour an effect which is really due to diminished reflection of the interior surface of your cylinder.

But why should the aqueous vapour so condense? The tube within is warmer than the air without, and against its inner surface the rays of heat are impinging. There can be no tendency to condensation under such circumstances. Further, let 5 in. of undried air be sent into the tube—that is, one-sixth of the amount which it can contain. These 5 in. produce their proportionate absorption. The driest day, on the driest portion of the earth's surface, would make no approach to the dryness of our cylinder when it contains only 5 in. of air. Make it 10, 15, 20, 25, 30 in: you obtain an absorption exactly proportional to the quantity of vapour present. It is next to a physical impossibility that this could be the case if the effect were due to condensation. But lest a doubt should linger in the mind, not only were the plates of rocksalt abolished, but the cylinder itself was dispensed with. Humid air was displaced by dry, and dry air by humid in the free atmosphere; the absorption of the aqueous vapour was here manifest, as in all the other cases.

No doubt, therefore, can exist of the extraordinary opacity of this substance to the rays of obscure heat; and particularly such rays as are emitted by the earth after it has been warmed by the sun. It is perfectly certain that more than 10 per cent. of the terrestrial radiation from the soil of England is stopped within 10 ft. of the surface of the soil. This one fact is sufficient to show the immense influence which this newly-discovered property of aqueous vapours must exert on the phenomena of meteorology.

This aqueous vapour is a blanket more necessasy to the vegetable life of England than clothing is to man. Remove, for a single summer night, the aqueous vapour from the air which overspreads this country, and you would assuredly destroy every plant capable of being destroyed by a freezing temperature. The warmth of our fields and gardens would pour itself unrequited into space, and the sun would rise upon an island held fast in the iron grip of frost. The aqueous vapour constitutes a local dam, by which the temperature at the earth's surface is deepened; the dam, however, finally overflows, and we give to space all that we receive from the sun.

The sun raises the vapours of the equatorial ocean; they rise, but for a time a vapour screen spreads above and around them. But the higher they rise, the more they come into the presence of pure space, and when, by their levity, they have penetrated the vapour screen, which lies close to the earth's surface, what must occur?

It has been said that, compared atom for atom, the absorption of an atom of aqueous vapour is 16,000 times that of air. Now, the power to absorb and the power to radiate are perfectly reciprocal and proportional. The atom of aqueous vapour will therefore radiate with 16,000 times the energy of an atom of air. Imagine, then, this powerful radiant in the presence of space, and with no screen above it to check its radiation. Into space it pours its heat, chills itself, condenses, and the tropical torrents are the consequence. The expansion of the air, no doubt, also refrigerates it; but in accounting for those deluges, the chilling of the vapour by its own radiation must play a most important part. The rain quits the ocean as vapour; it returns to it as water. How are the vast stores of heat set free by the change from the vapourous to the liquid condition disposed of? Doubtless in great part they are wasted by radiation into space. Similar remarks apply to the cumuli of our latitudes. The warmed air, charged with vapour, rises in columns, so as to penetrate the vapour screen which hugs the earth; in the presence of space, the head of each pillar wastes its heat by radiation, condenses to a cumulus, which constitutes the visible capital of an invisible column of saturated air.

Numberless other meteorological phenomena receive their solution by reference to the radiant and absorbent properties of aqueous vapour. It is the absence of this screen, and the consequent copious waste of heat, that causes mountains to be so much chilled when the sun is withdrawn. Its absence in central Asia renders the winter there almost unendurable; in Sahara the dryness of the air is sometimes such, that though during the day "the soil is fire and the wind is flame," the chill at night is painful to bear. In Australia, also, the thermometric range is enormous, on account of the absence of this qualifying agent. A clear day, and a dry day, moreover, are very different things. The atmosphere may possess great visual clearness, while it is charged with aqueous vapour, and on such occasions great chilling cannot occur by terrestrial radiation. Sir John Leslie and others have been perplexed by the varying indications of their instruments on days equally bright; but all these anomalies are completely accounted for by reference to this newly-discovered property of transparent aqueous vapour. Its presence would check the earth's loss; its absence, without sensibly altering the transparency of the air, would open wide a door for the escape of the earth's heat into infinitude.

CALIFORNIA MINING IN 1862.

THE *Mercantile Gazette and Prices Current* of San Francisco, publishes an interesting abstract of the progress and condition of mining in California during the past year. It says:—"During the past year the operations in gold mining have usually been attended with fair average success. The gradual diminution of the yield of the older fields has been compensated by the new discoveries that have been made in other vicinities, so that the total gold product of the year has probably fallen but little, if at all, behind that of the past four or five seasons."

Hydraulic Engineering.—California is the most extraordinary country in the world for hydraulic engineering connected with gold mining. Some of the hydraulic works are stupendous in magnitude, and they exhibit great originality of genius, enterprise, and daring. The following extracts from our cotemporary, on this head, are of decided interest:—

"At Michigan Bluff, midway between Downieville and Placerville, on the North Branch of the Middle Fork of the American river, hydraulic mining has been vigorously and successfully prosecuted. Owing to the formation of the land, the sluices are laid in long tunnels, 100 ft. under ground. The water is carried in iron pipes upwards of 3,000 ft., and has a fall of 300 ft. Seven of such tunnels were in use in June, and more than a dozen others were shortly to be commenced to work other claims.

"In Siskiyou, along Scott river and its vicinity, the yield was larger than for several years past, and a number of rich claims were mentioned, in one of which a 450 dol. nugget was found. The river claims were worked very extensively, the number of water wheels erected being greater than ever before.

"At French Carrol, in Pollard's claim, in March last, a tunnel 2,800 ft. long was completed after two years' labour. Seventy-five men were employed and 800 in. of water used in the claim, and 5,000 dols. 17,000 dols. and 20,000 dols. were cleaned up at different times after operations commenced."

Amalgamating.—The only improvement noted during the past year in this class of mining was a greater saving of the gold in the shape of amalgam taken from the riffles and amalgamated coppers of sluices by means of nitric acid. It has been found that what was formerly regarded as refuse and thrown away, if slowly evaporated, frequently still yields a considerable quantity of gold. The Columbia Fluming Company thus save sufficient to pay the salary of their superintendent.

Blasting.—At Smartsville, in Bradley's hydraulic claim, in October, a blast of 500 kegs of powder was fired, for the purpose of pulverizing the hard cemented gravel, and preparing it for washing. The bank was 85 ft. in height. From this a tunnel 190 ft. in length was run, with seven side drifts of 10 to 15 ft. long. In these the powder was deposited, and five lines of fuse carried thence to the entrance. For a distance of 75 ft, from the entrance, the tunnel was then tightly closed, and packed or "tamped" with earth. When the explosion occurred, the hill, for a distance of 300 ft. front and rear, and from the bed rock to the surface—a depth of from 85 to 120 ft., composed principally of hard grey and blue cement—was thoroughly pulverized, and the surface thrown in ridges, as though newly ploughed. The cost of the blast was 3,300 dols. The saving of labour was about 30 per cent. To wash the soil thus prepared would require a stream of 400 in. of water for over three months, for which the outlay would be 5,000 dols, and 1,500 more would be expended for the labour required. 20,000 dols. was refused for the product.

Product of Gold and Quicksilver.— The total value of the treasure obtained from all the California mines in 1862 was 42,539,799 dols., of which 4,989,921 dols. were coined in San Francisco. In 1861 the total value was 41,689,077 dols.: in 1860, 45,211,693 dols. The quicksilver product of California mines is prodigious. Last year it amounted to 3,025,875 lbs.; most of this was exported.

BIDDELL'S RAILWAY CROSSINGS.

THE patentee of the well-known "chilled" cast-iron railway crossings, Mr. G. A. Biddell, of Ipswich, has lately taken out a patent for additional improvements in the construction and manufacture of "chilled" cast-iron railway crossings, for which letters patent were granted, bearing date 19th September, 1855, No. 2113. It has been found that when the chilling of the upper wearing surface of the crossings is carried quite up to the rail ends of the crossing, as in his former patent, the extreme end edges of the chilled wearing surfaces are liable to chip or break off in small fragments from the weight and action of the wheels of the engines and carriages running over such crossings; it has also been found that the "point" in these chilled crossings (where it is formed as a portion of the main casting and chilled upon all its upper wearing surface, thus being made hard and brittle) is sometimes liable to be broken off by a side blow from the wheel flanges, and thus, besides being unsightly, the sharp edges caused by the fracture occasionally cut the wheel tyres running against them. Now the object of these improvements is to remedy the defects and inconvenience above set forth. This is proposed to be done by preventing the chilling action taking place quite up to the extreme ends or point of the upper wearing surface of the crossings. This will leave the parts which have been found liable to chip and break off less brittle, more tough, and much less liable to chip or break than when chilled at those parts as heretofore. This effect is produced by the proper use of "cores," or sand, or other suitable material, in connection with the iron or chill producing portions of the mould previous to casting the crossing.

Fig. 1 is a longitudinal section of a mould in which the patent crossings are cast; and fig. 2 is a plan of a crossing made according to the present invention.

In fig. 1 *a* and *b* are the boxes or flasks which contain the entire mould; *c* is the lower or iron portion of the mould for producing the "chilling action" on the upper or wearing surface of the finished crossing; *d* and *e* are "cores," of sand or other suitable material, for preventing the chilling action taking place at the extreme ends of the wearing surface; and *f* is a similar "core" for forming the point of the crossing. The rest of the mould is formed with ordinary moulding sand, *g*. In fig. 2, *h*, *i*, *j*, are the portions which have been found liable to chip and break off, and are therefore formed by the cores, *d*, *e*, *f*, which prevent the chilling action and leave those parts more tough and less liable to chip or break than when chilled as heretofore.

BIDDELL'S "CHILLED" CROSSINGS.

FIG. 1.

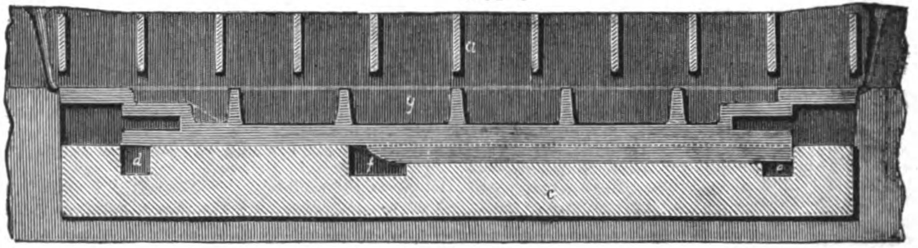
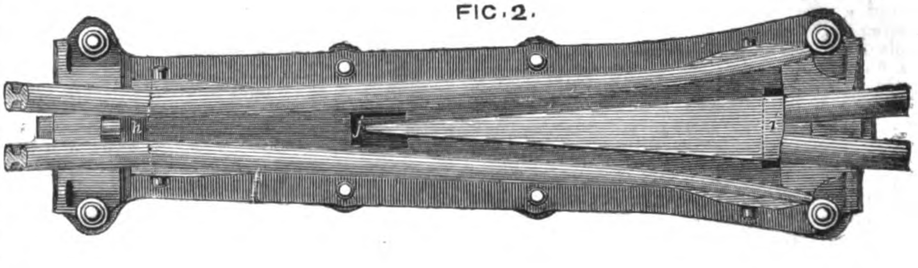


FIG. 2.



WEILD'S MACHINE FOR CUTTING AND SHAPING METALS.

MR. WILLIAM WEILD, of Manchester, whose patent spooling machine attracted some attention in the Western Annexe of the International Exhibition, has lately taken out a patent for several improvements in workshop tools.

The following is a description of one of his improvements, consisting in an arrangement of machinery for cutting, shaping, drilling, and rolling combined in one machine. This compound machine is more especially adapted for the manufacture of fire-box stays or bolts for locomotives and other boilers. The action is as follows:—The rod of copper, iron, or other suitable metal to be operated upon is fed forward by the attendant at intervals to be compressed between two dies to form squares, if requisite, at the end of each stay or bolt, while the rod is held between the dies, a cutter descends and cuts off the piece forming the stay or bolt close by the square dies; the piece so cut off drops between three rollers, two of which are in motion, the other roller has a movement given to it in a vertical direction by a cam action from the main shaft; such movement allows the piece forming the stay to get in between the rollers on the top side, and when rolled to drop out from between the rollers on the under side. During the operation of rolling drills are brought into operation for centering the ends.

Fig. 1 is an elevation in section of a machine for shaping, cutting, and rolling copper stays or bolts for locomotive or other boilers, or for shaping, cutting, and rolling other metal, for any purpose to which it may be applicable. Fig. 2 is a front elevation.

a is the framing supporting the driving shaft *b*, to which motion is communicated by steam or other power; the pinion b^1, keyed on the shaft *b*, gears into the wheel c^1 on the top shaft *c*, which is provided with three eccentrics; the eccentric c^1 is for shaping the bar of metal to be operated upon marked *d*, the eccentric c^2 is for cutting off a portion of the bar, and the eccentric c^3, is for actuating the rocking frame *e*, in which the roller *f* revolves. The machinery for shaping the square or other shaped head on the stay or bolt consists of the fixed lower die *g*, and the moveable upper die g^1, screwed to the slide g^2, which is hinged to the link g^3, fitting on the eccentric c^1. The machinery for cutting off the bolt or stay consists of the cutter *h* screwed to the slide h^1, which is connected by the link h^2 to the eccentrics e^2, and the machinery for rolling the stay or bolt consists of the rollers *i* and *j*, which revolve in stationary bearings, and the roller *f* revolving as before stated in the swing frame *e*, which is actuated by the link c^1, and eccentric c^3, the rollers *i* and *j* are made to revolve in the same direction, as indicated by arrows, by the wheel b^2, on the driving shaft *b*, gearing into the wheel *k*, keyed on the cross shaft k_1, on which are fixed the pinions k^2 and k^3; the former drives the roller *i* by

WEILD'S MACHINE FOR CUTTING AND SHAPING METALS.

FIG. 1.

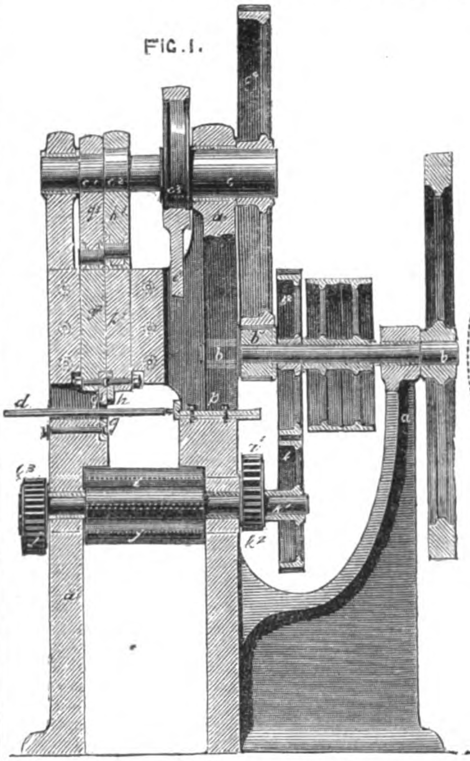
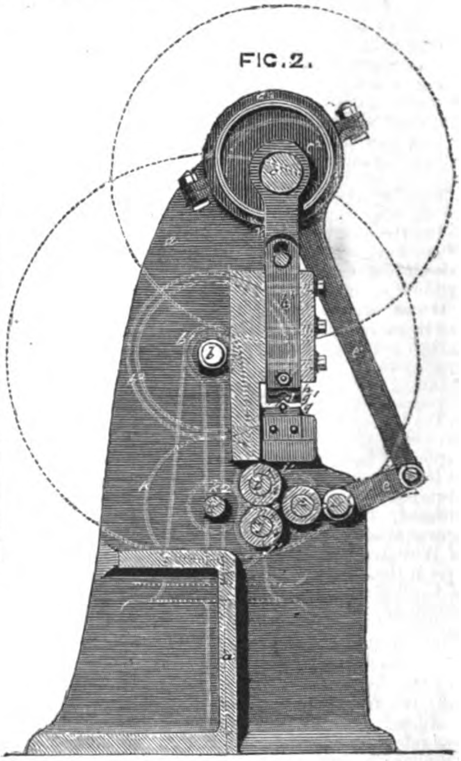


FIG. 2.



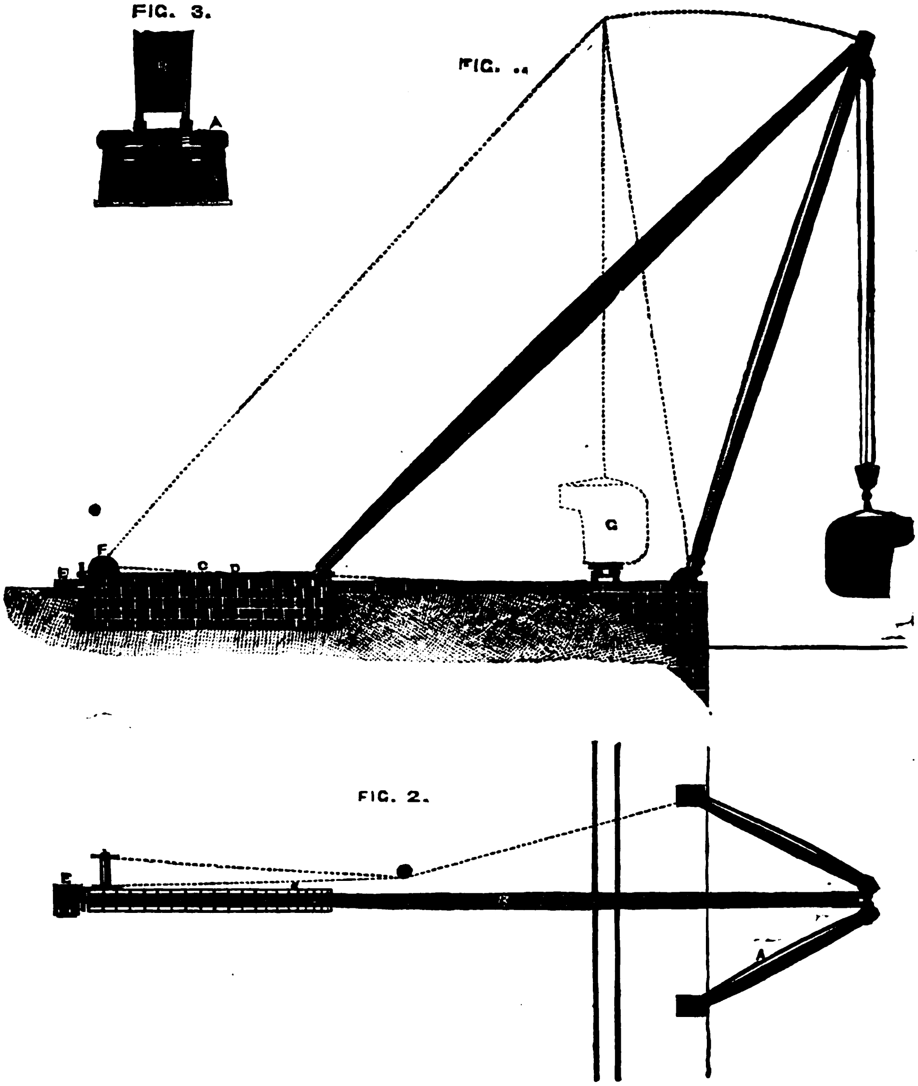
the pinion i^1, and the latter drives the roller *j* by the pinion j_1. The mode of operation is as follows:—The rod of copper, iron, or other suitable metal marked *d* is fed forward by the attendant at intervals, the advance of the rod being arrested by the adjustable stop plate *p* when the rod has been compressed between the dies and g^1, by which square or other shaped heads are formed if requisite at the end of each stay or bolt; while the rod is held between the dies *g* and g_1, the cutter *h* descends and cuts off the piece forming the stay or bolt close by the square dies, the piece so cut off drops between the three rollers *f*, *i*, and *j*; the two latter of which have a rotary motion given to them as above described, and the roller *f* has a movement given to it in a vertical direction by the eccentric c^3; this vertical motion is so timed that when the piece forming the stay or bolt drops, the roller *f* is below the centre of the rollers *i* and *j*, and allows the piece forming the stay or bolt to get in between the rollers from the top side, and the roller *f* in rising compresses and rolls the stay or bolt between the three rollers. When the roller *f* is in its highest position, the rolled stay or bolt drops out from between the rollers and falls into a receptacle placed underneath.

DAY AND SUMMERS' PATENT SHEER LEGS.

ON page 126 of this volume, we noticed a trial of sheer legs at Southampton, the invention of Messrs. Day and Summers, of the Northam Iron Works, in that town. We are now enabled to present our readers with an illustration showing the arrangement. The invention consists, first, in connecting the lower end of the back leg to a screw, worm, pinion and rack, hydraulic ram, or other like mechanical contrivance for imparting to and fro motion to the back leg, in order that it may act as a prop to the front legs when they are moved inwards, and as a guy to them when they overhang outwards. The front legs are of the ordinary construction, and work in the usual manner. The invention also consists in the employment of a load at the lower end of the back leg. This loaded leg then acts to some extent as a back balance.

The engravings show the back sheer leg made to travel to and fro by means of a screw and nut. Fig. 1 is a side elevation of ordinary sheer legs, with the means of working the back leg partly in section; fig. 2 is a plan, and fig. 3 is a cross section in the line *x*, *x*, of fig. 1. A, A, are the front legs, working in the ordinary manner; B is the back sheer leg, connected at top to the front legs in the usual manner; C is a foundation of masonry or other solid work, on which iron plates D, D, are secured; these plates are formed with a groove or channel on their inner sides for receiving trunnions *a*, *a*, which also act as counterbalance weights, projecting from the lower end of the leg B, or from plates connected to it, as shown in the transverse section, fig. 3; *b* is a nut united to the trunnions *a*, *a*, through which a screw *e* passes; this screw is free to revolve in eyes or bearings *c*, *c*, bolted to the foundation; F, F, are wrought-iron plates bolted on to the flanged plates D, D, to prevent the trunnions rising when the leg is made to move to and fro along the channel in the plates D, D. The screw may be worked by a steam-engine, as shown, or it may be made to revolve by hand, or otherwise. F is a chain barrel for raising and lowering weights to be lifted or moved by the sheers.

DAY AND SUMMERS' SHEER LEGS.



THE MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

AT the annual meeting of this association, which was held last month, some useful suggestions were made by some of the speakers.

Mr. Hugh Mason said that, in looking at the report, he had noticed with great pleasure the considerable increase made in the number of "Thorough examinations" during the year 1862, as compared with the year 1861, or indeed of any year since the foundation of this association. He had always availed himself of the privilege of having a "Thorough examination" of each of his boilers once a year, having made his arrangements so that this could be done at the ordinary visits of the Inspectors without any extra charge. This being the case, he felt the greatest confidence as to the security of his boilers. He was glad to see that these "Thorough examinations" were increasingly appreciated, since he was convinced that with whatever vigilance "External" inspections were made, still there would frequently be lurking concealed defects seriously affecting the safety of the boilers, which could only be detected on "Thorough examinations." It was only a few days since, that, in consequence of a recommendation received in the report on the Inspector's examination of his boilers, he was induced to drill through some plates that appeared to be thinned by corrosion, and having tested them in that way he felt a confidence in their sufficiency which he could not otherwise have done.*

Mr. Mason then referred to the records kept at the office, which comprised the experience derived from the continued inspection of this association, and thus became a most valuable reference to its members. He then alluded to the subject of incrustation, which the water supplying his boilers was very prone to form. He had consulted Mr. Crace Calvert on the subject, and obtained a recipe, for which he most cheerfully paid him his fee; the advice was simply to put in a certain amount of common soda and logwood sawdust, which he had adopted for the last five years, and found it to prove most beneficial, and therefore recommended the remedy to any one else troubled in the same way.

Mr. Adamson stated that he had supported the association from its commencement, and his knowledge of the advantages which resulted from it would induce him to do so still further. The monthly reports of the engineer demonstrated that the association was of the greatest importance, since they not only gave records of any disasters which had taken place, but also afforded information to one member of any progress attained by another, and thus placed it at the disposal of all. He had taken considerable interest in that most fatal explosion that had lately occurred at Masboro', and had, since its occurrence, visited the works, and examined the fragments of the boiler, as well as read the report of the association's engineer upon it. He found that the results arrived at, in that report, were directly contradictory to those of Mr. Dodd, who was officially engaged by the coroner to investigate the subject, as well as to those of the jury; Mr. Fletcher attributing the explosion to original mal-construction of the boiler, while Mr. Dodd and the jury, to shortness of water. From the examination he had made, he quite concurred with their own engineer, and attributed the explosion to defective construction, and thus did not agree in the condemnation of the poor engine tenter, who, he thought, had been unfairly treated in being committed to prison. He believed that, had the boiler been under the inspection of this association, the flue would not have been allowed to work without a strong remonstrance, the weakness of its construction pointed out, and a suitable remedy proposed. Mr. Adamson next alluded to the subject of "grooving" or "furrowing," already referred to by the President, and stated he was glad that the monthly reports had gone so fully into this subject, and with the views expressed therein he entirely agreed. It was one to which he attached considerable importance; and since there had been several recent explosions of locomotive boilers from this cause, it became a subject in which all were interested, since it affected the safety of every railway traveller. He thought that mechanical action was the most important element in the formation of these grooves, and pointed out that, in the case of the boiler that exploded on the London and North-Western Railway, the furrow had occurred just in the weakest part of the cylindrical portion of the shell, namely, midway between the fire-box and smoke-box, and close to the lap of a single-riveted seam. He thought the only way to prevent this furrowing action, was to make the cylindrical portions of the boiler truly circular. He had also a high opinion of drilling all the rivet holes, which was much superior to punching. Drilling made parallel holes, while punching never could. Mr. Adamson went into this subject with considerable minuteness and detail, and then passed on to the consideration of surface condensation, the adoption of which he thought would be attended with great benefit. He alluded to the fact that the constant use of precisely the same charge of water round and round, had been found to act injuriously upon the surface of the plates, but that by a slight admission of other water, or by permitting the boiler to be coated by a thin film of incrustation, the difficulty was removed. Mr. Adamson then alluded to superheating, stating how important it was to maintain the temperature of the steam while in action, since the total quantity of heat contained in a cylinder full of steam was so small, that it required to be tenderly dealt with and carefully preserved. He considered that very much was due to the president of this association for the experiments he had instituted for the exact determination of various mechanical questions, and that the data which the engineering world was already in possession of through Mr. Fairbairn's exertions had been of great benefit. He remembered the empirical laws which, but a few years since, were laid down by boiler-makers relative to the strength of seams of rivets, the folly of which, he was happy to say, had been rendered manifest by the investigations referred to.

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* When plates are weakened by corrosion, it is important that they should be tested by drilling through them. An examination merely of the surface is frequently deceptive, especially when the wasting is general and the corroded surface smooth.

Mr. Alexander stated that with regard to the hydraulic test, he highly approved of its application to every description of boiler, whether stationary or locomotive, and had been in the habit for years of applying it himself to locomotives, both old and new; and thought that the frequency with which explosions had lately occurred to this class of boiler, demanded that the objections held by some to this test, should be carefully reconsidered.

SOCIETY OF ARTS.

At the meeting of this society on Wednesday evening, Sir Thomas Phillips, F.S.S., chairman of council, in the chair, the Paper read was "On an International Transit Route through Nicaragua," by Commander Bedford Pim, R.N. The author pointed out the importance of the subject as bearing upon the political and commercial position of this country. He described the railroad that now exists across the Isthmus of Panama, which had now the monopoly of the traffic, the company charging rates of transit that were most exorbitant. As showing the view taken by the American Government of the importance of this means of transit to the United States, the author quoted from the State paper in which the Government aid asked for by the proprietors of the Panama line was granted. This document spoke of the advantages the United States would possess over all competitors for the commerce of the Pacific and the East when the line was completed, which would deprive Europeans of the decided superiority which they formerly possessed in their intercourse with nine-tenths of the world, and would place the States far a-head in the race of commercial supremacy. Captain Pim then described the line which he proposed should be constructed through Nicaragua for the purpose of practically joining the Atlantic and Pacific in European interests. He urged that the monetary interest England has in having at her command a settled and expeditious transit between home and the Pacific, and thence to British Columbia, Japan, Australia, and New Zealand, is very great. This communication should be independent of the control of the United States. His proposed railway starts from Gorgon Bay, on the Atlantic, traverses the intervening land as far as the Lake Nicaragua, then skirting the shores of that lake, crossing the river Tipitapa, and reaching the Pacific at the harbour of Realejo, a total distance of 225 miles. The author stated that the Emperor of the French took very great interest in the subject, and had written a pamphlet upon it himself, in which he especially pointed out the bearing of this question on the commercial interests of England. A discussion ensued, in which several gentlemen took part, amongst whom were Messrs. Charles White (Consul-General for Nicaragua), P. G. C. Curtis, W. Hawes, J. H. Murchison, &c.

GRINDING AND POLISHING TOOLS AND SURFACES.

The use of grinding wheels seems to be extending itself in mechanical workshops. The following is an account of a patent for this description of workshop tool, lately taken out by Mr. George Coles, Gresham-street, City, Mr. J. A. Jaques, and Mr. J. A. Fanshawe, both of Tottenham.

These improvements in the manufacture of grinding and polishing tools and surfaces, relate, in the first place, to a mode of producing such articles by a combination of pulverized gritty or cutting ingredients with a preparation of oxydized or other oil and sulphur, with or without the addition of resinous, gummy, mucilaginous, or albuminous matters.

In carrying out this part of the invention, either emery, pulverized glass, fine granulated iron, or fine iron or steel filings or borings, or other hard cutting substances reduced to a finely divided state, are used, and these substances are combined with any suitable oil and resinous, bituminous, or gummy matter, or mucilaginous or albuminous matters, in some cases with the addition of sulphur or sulphurets, taking care that all the ingredients be well mixed or incorporated, so that the whole mass may be brought as near as possible to a homogeneous state. It is not material to mix the ingredients in very precise proportions, and therefore the gritty or cutting substance, such as the emery, is to be combined in as large a proportion as possible with the agglomerating substance, so that the tool when made may be the more effective. Linseed oil or oxydized oil, with about half its weight or any other convenient proportion of shellac, asphalte, or bitumen added thereto, so as to produce a thick paste, will form a good composition to bind the gritty or cutting materials together, and to this must be added from five to ten per cent. of pulverized sulphur when iron or steel filings form no part of the composition; when those metals are employed as the cutting substance, sulphur must be omitted from the composition. These compounds must then be submitted to about 300 deg. to 350 deg. of heat, in an oven with a dry heat, or in an atmosphere of steam of the requisite temperature, so as to harden the substance sufficiently to admit of it being used as a polishing tool or surface. As the compound before heating will be in a plastic state it may be moulded into any required form according to the purpose for which the tool is to be used. The most generally useful form of grinding tool will be one fixed on an axle, so that rapid rotary motion may be communicated to it. The grinding edge of these tools may be moulded in any shape according to the work they are required to do.

The invention consists, secondly, in combining fine steel or other hard wire with any suitable plastic material, such as that above mentioned, so as to produce a cutting surface like a file or rasp. To this end any convenient quantity of the fine steel or other hard wire is arranged in a suitable manner according to the form of which the tool is to be made, and then the plastic materials are added by forcing them in between the wires, so as to hold or retain the fine steel or other wires in their place. If it be desired to produce a grinding wheel, the wires must, of course, be arranged radially round a centre, and then secured in their proper positions by means of the plastic materials, as before mentioned.

Meetings for the Week.

Mon.—*Inventors' Inst.*, Polytechnic, Renewed discussion upon Capt. Selwyn's paper, "On the Inventions hitherto adopted for the Submergence of Telegraphic Cables," at 8.30 p.m.
Medical, "Clinical Discussion," at 8.30 p.m.
London Inst., "On Music," by Josiah Pittman, Esq., at 7 p.m.

Tues.—*Inst. Civil Engineers*, 1, Discussion upon "The Perennial and Flood Waters of the Upper Thames." 2, "Description of the Lydgate and Buckhorn Weston Railway Tunnels," by J. G. Fraser, Esq., at 8 p.m.
Royal Inst., "On Animal Mechanics," by Prof. Marshall, at 3 p.m.

Wed.—*Soc. of Arts*, "On the Suppression and Extinction of Fires," by C. B. King, Esq., at 8 p.m.

Thur.—*Antiquaries*, Ballot for the Election of Fellows, at 8.30 p.m.
Linnæan, at 8 p.m.
Chemical, at 8 p.m.
Royal Soc., at 8.30 p.m.
Royal Inst., "On Chemical Affinity," by Dr. Frankland, at 3 p.m.
Numismatic, at 7 p.m.
Royal Soc. Club, at 6 p.m.

Fri. — *London Inst.*, "On Economic Botany," by R. Bentley, Esq., at 7 p.m.
Architectural Assoc., "Gothic Woodwork," by R. O. Harris, Esq.
Royal Inst., "On Magnetic Forces," by B. Stewart, Esq., at 8 p.m.
Philological, at 8 p.m.
Royal Horticultural, Council at 11 a.m. Election of Fellows.

Sat. — *Royal Inst.*, "The Science of Language," by Prof. Max Müller, at 3 p.m.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—W. R. M.—L. T.—Captain N.

T. F. S. (Blackburn).—Thanks.

L. M. Not yet received.

W. W. (Portsmouth).—If you like to forward us a plain, clear description, and a similar drawing of your proposed plan, we shall be happy to publish it, supposing that it be really meritorious and novel.

Safety (Newcastle).—There is little doubt, and it is an opinion we have lately expressed in a Paper on "Safety Lamps," that accidents from inflammable gas are often caused by the insufficiency of the light afforded by the ordinary safety lamp. The collier is continually tempted to uncover the light.

Tool-box.—There is no doubt that occasionally reversing the beds of planing machines (when this can be done), equalizes the wear of the slides and keeps them true.

F. A. B. (Llanelly.)—The value of any metalliferous ore can only be ascertained by an accurate quantitative analysis, conducted by a competent chemist.

Boiler Scale.—In addition to Mr. Fletcher, you will find by our number for Jan. 30th, that a member of the Manchester Philosophical Society, Mr. Spence, also advocates the use of *carbonate of soda* in steam-boilers. There is no novelty in the proposal of this chemical nostrum for the purpose indicated. Mr. Spence (whom we believe to be a manufacturer of chemicals) appears to think that the idea is new. The German chemist, Fresenius, in 1851, advocated the use of alkaline solutions, such as carbonate of soda and caustic soda, to render the salts of lime more soluble contained in the water used for raising steam. The idea of using these substances was first originated by the observation that certain waters naturally containing alkaline solutions, deposit no incrustation when used in a steam-boiler. A full account of the rationale of the matter will be found in the "Journal für Practische Chemie," No. 2, 1853. Professor Fresenius persuaded a German manufacturer to adopt his plan. Unfortunately, the plates of the boilers were, shortly afterwards, found to be strongly corroded by the soda. This deleterious action on the plates has been ascribed to the presence of cyanide of sodium in the soda, a substance which is almost always present in the soda of commerce. Another very strong objection would probably be found in the use of an alkaline solution in a steam-boiler. In case the boiler primed at all, the alkaline water would be taken with the steam into the steam-pipes and engines, and thus react upon the joints, packings, &c. The use of almost any chemical in a boiler would always be a delicate matter. The water used would require to be quantitatively analyzed in order to determine the proper amount of the chemical to be added. The firemen would have to be strictly watched to see that the determinate quantity is never exceeded. The efficacy of the given chemical would, evidently, vary in degree for different waters. It may be generally stated that the proposals for using these chemical nostrums almost always take their rise with manufacturers of chemicals; looking for a profitable *debouche* for the waste refuse of their works.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

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IRON OR WOOD FOR THE NAVY?

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Was I not right in predicting that the Controller of the Navy would make a bold stand for wood? He has fairly joined issue in the case of "Iron *v.* Wood." He has drawn his brief and pleaded his cause in a statement,* presented to the Admiralty, "on the relative advantages of iron and wood, and cost of those materials in the construction of ships for Her Majesty's Navy." He has put us in possession of the whole of his case—he has set forth his best points and arguments. We can meet him face to face and go fully into the merits of the question.

Admiral Robinson divides his subject into two parts: 1st—The nature of the material (iron or wood); 2nd—Where and how the ships, whether of wood or iron, shall be constructed. On the first point, the Controller honestly confesses that the advantages preponderate greatly in favour of iron. Nevertheless, he comes to the conclusion that wood is the more suitable material. "An iron ship," he says, "can be built of larger dimensions than a wooden ship, *with no loss of strength.* An iron ship has more rigidity and strength of structure as a whole, than a wooden ship, though locally weak, and liable to be penetrated by blows which would fall harmlessly on a wooden ship. An iron ship has much greater durability than a wooden ship, and after a lapse of years the iron frame would have suffered *next to nothing* as compared with a wooden ship. But against these advantages must be set the serious local weakness of the comparatively thin plates of which the bottom of an iron ship is necessarily composed, and the rapidity with which the bottom of an iron ship gets foul."

These two objections, in the opinion of the Controller, decide the question against iron. They outweigh the substantial advantages of strength and rigidity of structure, of durability and peculiar adaptability of the material for ships of large dimensions.

The coincidence between these conclusions, and the arguments advanced by Mr. Reed in support of his system of "wooden bottoms," is so close and so exact, that it goes far to prove the complicity between him and the Controller, which I some time ago alleged was the bond of union between them, and which accounts for the appointment of the former to the office of Chief Constructor.

It will not, I think, be difficult to show that the case got up by the joint efforts of the Controller and his new subordinate, is of the weakest. The main pleas of the advocates of iron are admitted—they are undenied, because they are undeniable; but all-important as they are, they are to be ignored and abandoned, because ships' bottoms made of *thin* iron plates are locally weak, and because iron bottoms foul. We have a case presented to us, in which the points, major and minor, are carefully and correctly set forth—the major are rejected, and the minor are adopted. In iron, we may have ships vastly superior in strength, rigidity, and durability to any ships of wood, and we are to renounce those positive and permanent advantages on account of two objections which may be remedied if not removed. An absolute gain is to be sacrificed to avoid an occasional inconvenience.

But let us see what those objections amount to. On several occasions I have stated my belief that the Admiralty in its ardent attachment to wood, and bitter enmity to iron, knowing the inutility of denying the palpable advantages of iron, eagerly laid hold of the defective points in that material, and pertinaciously thrust them forward, with a predetermination to have recourse to no means, to listen to no recommendations, to make no experiments with the view of ascertaining whether these objections could be removed.

This charge, monstrous as it appears, as against a great public department, is justified by the course taken by Admiral Robinson in his statement. He does not stop to inquire what, or if any, remedies can be found for the minor drawbacks to the use of iron; he says nothing about the proposals which have been urged on the notice of the Admiralty for their removal.

The fact, however, is that many practical plans have been again and again laid before the Admiralty for strengthening the bottoms of iron ships, so as to make them stronger than the bottoms of wooden ships, and for coppering the bottoms of iron ships as effectually as those of wooden ships. But a deaf ear has been turned to every proposition of that kind. The plans are laid aside, no attempt having been made to give them a trial at the expense of a few hundred pounds. For the favourite material, wood, of which the heavy Government purchases are a mine of wealth to the fortunate contractors, millions are lavishly expended; and every kind of experiment, although it be at the expense of an "Enterprise" or a "Favourite," which gives wood a chance, is not considered too costly.

Now that Mr. Cobden's intended motion with reference to "obsolete men-of-war" has brought the question of "iron *versus* wood" so prominently forward, I hope the House of Commons will seize hold of the two points on which the whole matter hinges, and will imperatively call Ministers to account for not having recourse to the most energetic measures, and for not making experiments for the purpose of remedying the only two objections which exist for wholly relinquishing the construction of wooden ships, and for constructing the "Navy" of the future entirely of that material—iron—which undeniably and with the assent of the Controller of the Navy possesesses advantages so vastly superior to its competitor—wood.

I cannot dismiss the first point without reverting to the adroit manner in which the high authority of M. Dupuy de l'Orme's name is cited in support of the construction of line-of-battle ships in wood. Admiral Robinson says that "That eminent designer is of opinion that it is wiser and more economical to *supply the wants of the moment* by a cheaper and less durable structure; and therefore constructs the ships that are to form the French line of battle of wood *in preference* to iron" This is begging the question, and says nothing in favour of wood. The French don't build *iron* line-of-battle ships, because they can't. They employ wood, not *in preference to iron*, but because they are compelled. To produce the iron fleet we have created, and shall have afloat within a period altogether of 3 or 4 years would require 10 years in France; and within another period of 3 or 4 years, we can increase the iron ships in our navy to a number which will make it effective, and which it would take the French another 10 years to equal.

The argument drawn from M. Dupuy de l'Orme's practice falls to the ground. Properly considered, his experience is a condemnation of wood, which, according to Admiral Robinson's own statement, has been used as the material for French iron-clads, not from choice, but from necessity. The leaky condition of the "La Glorie" and "Normandie" has been repeatedly stated in French Naval reports, and, no doubt, is well known to our Admiralty. That we are not in the same predicament as the French from poverty of resourses to build iron ships, is proved by what we have done. It is a lame and impotent conclusion to argue, from the necessity of another nation which does not exist with us, that we must imitate what they are obliged to do when a similar obligation is not imposed upon ourselves. The Controllor and Chief Constructor must be hard driven to make out their case, when they have recourse to so weak and illogical an argument.

The second point, "when and how the ships shall be constructed," is one which requires deep and mature consideration. The best solution of this question will, I believe, be found in a combination of the resources of public dockyards and private contractors, creating a competition between the two in economy and perfection of work, and placing Government in the position of knowing practically what a ship costs and how it ought to be constructed.

Civilian.

WOOD *versus* IRON BACKING FOR SHIPS.

Sir,—Almost the only practical information which the public has been afforded concerning the construction of, and experiments on, the new armour-clad ships, has come to them through the medium of your columns. The able letters of your correspondent "Civilian" have, above all, illuminated the subject; both from the clearness and force of their arguments, and the information as to facts with which they abound.

The advantages which would be possessed by ships constructed solely of iron, as advocated by "Civilian," over combined structures of wood and iron, are no doubt very great—a fact to which the eyes of the Government Committee have evidently been wide open, and to the realization of which their efforts have apparently been mainly directed. It is, however, a question open to serious doubt, whether a wood backing can ever be dispensed with, at all events, until some entirely radical change in the system of construction is adopted, or until the limits at present imposed on the thickness of armour plates by the necessities of manufacture and of naval architecture shall be very greatly extended. A consideration of the effect of shot-impact on an armour plate will at all events indicate the reasons for such an opinion.

When a plate is struck by a shot, the effect on it is twofold, consisting of a movement of the general mass of the plate inwards, with a velocity due to the absorbed momentum of the shot, and also a bulging of the plate on its inner surface, behind the locus of the impact. If there be a wood backing, the plate will be supported over its entire surface, and the motion given to it by the shot will be suppressed by a pressure exerted over a very considerable space, and there will be less tendency to buckle than if the plate were supported by rigid ribs at some distance apart. But the more important considerations in favour of wood backing is due to the effect mentioned secondly, namely, the bulging of the back of the plate. If there be nothing intervening between the skin and the armour plate, it is evident that this protuberance on the plate will cause the surfaces of the skin and plate to be separated, shearing the bolts and tending to rend the skin itself. If the shot strike the plate over a rib, the space necessary for this bulge will be afforded, partly by indentation of the rib, and partly by separation of the plate from the rib. In either case, whether the shot strike over or between the ribs, separation of the plate, skin, and ribs must ensue, causing destruction of bolts and general loosening of the whole structure, while the ribs will themselves be liable to serious injury. The main advantage of wood backing is that these serious, and perhaps absolutely fatal, results are avoided. The space necessary for the bulge is afforded by the yielding nature of the wood with but slight comparative injury to the structure. The assistance which the wood affords the iron in simply resisting penetration, is probably hardly sensible. That is not the object of this backing; and, if it were merely intended for this end, it would not answer the purpose so efficiently as an equal weight of iron added in increased thickness of the plate; but an extra thickness of iron, though it would increase the actual resistance of the plate at its surface to penetration, would not fulfil the vitally important duties performed by the wood backing, namely, the diminution of buckling, of tendency to separation of the layers composing the ship's side, and of liability of the ribs to injury. Besides this, by giving the force which brings the plate to rest, after being set in motion by impact, a considerable distance to act through (owing to the elastic compressibiliy of wood), the backing much reduces the destructive effect on the ship's side.

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* The statement will be found in page 195.

It is urged that by retaining wood as a material in ship construction, we retain all the disadvantages of combustibility possessed by the former wooden ships. To this, it may be answered, that the great fault of the late construction was not its liability to fire, but its weakness of side, which allowed the penetration of the modern improved shells. The effect of these between decks is, of course, very great, from the smoke, confusion, and devastation they produce; but naval officers, who have, in the late wars, been close witnesses of their effect on ships, do not seem invariably to share the wholesome dread of them which has of late been so frequently expressed by advocates of naval reform in the House of Commons.

If wood is an indispensable element in armour ship construction, it by no means follows that the present mode of applying it is the best possible. In fact, the wood would, perhaps, be best applied merely as a pad between the plates and the ribs, the weight of wood which now backs the plates between the ribs being replaced by a similar weight of iron added to the thickness of the plates. If a plate could be used so thick that it would not be materially bulged by shot-impact, the wood might be dispensed with; but, until some other way is contrived of preventing the "bulge" from doing injury to the ribs, and causing separation from the frame of the ship of the armour plates, wood, or some similar substance, must be employed for this purpose.

The method of attaching the armour plates is at present very imperfect, both from the small amount of retaining force obtained, and from the weakening of the plates caused by the bolt holes. It is odd that the system of attachment round the plate edges has not been more thoroughly tried. It allows the application of almost boundless strength without in the least weakening the plate, and the force is also applied in the most advantageous way to resist "buckling," acting at the extremity of the lever formed by the plate. The experiment made on this method of attachment at Shoeburyness, last summer (*vide* Mechanics' Magazine), was made with a very inferior modification of the original proposal, patented in the beginning of 1862, by Mr. Plum.

It is to be regretted that more publicity is not given to the doings of the Committee on Iron Plates. In most other countries, important researches of this kind would be published as widely as possible, a course which is allowed to be attended with the best results. In the absence of information "by authority," the public is restricted to the information gleaned for them, with difficulty, by the press. If tolerably detailed descriptions and sketches of the various natures of armour structure lately experimented on were to be given in the Mechanics' Magazine, its readers would, no doubt, be greatly interested and instructed.

I am, &c.,
Iron.

AN ATLANTIC TELEGRAPH.

Sir,—Attempts by private enterprise have been lately, and are, perhaps, still, making to obtain funds to go on with the line from Ireland to Newfoundland. Whatever route may be best—on which subject I may, with your permission, make some remarks hereafter—there is, it is fully believed, no chance, as regards any route, of such attempts being successful. It is too much to expect that a *few* individuals should advance and peril their money on such an object. Why concentrate the risk on a few?—thus unwisely intensifying its effects. Why not diffuse the risk over as many as possible?—thus diminishing the risk in the like proportion. As the undertaking, if successful, would confer a vast national benefit, it ought, on every ground, to be made a national matter. We expend millions on Armstrong guns, with a readiness amounting to infatuation; but were Mr. Gladstone asked for a tenth part of the sum so expended to construct a telegraph to North America, we should be treated with fine, round, polished platitudes about private enterprise. Now, which would be most actively promotive of civilization, Armstrong guns, or a working telegraph to America?—which would be most creditable to the 19th century? There is no objection to the gun and also the iron-clad ship hobbies being ridden to a fair and due extent; but they need not be ridden so very hard, so very expensively, so very exclusively. Government is bound not merely to provide the means of protecting civilization, it is also equally bound to use every means for actively promoting it. By diligent attention to the latter duty, the discharge of the former will be rendered more and more easy, and more and more inexpensive.

A working telegraph to America, constructed by the Government of Great Britain, would be a most memorable—a most civilizing event—one to be looked to ever after with pride. By being national, the nation would be entitled to the whole honour—there would be nothing about it of the selfish, narrow, private exclusiveism of private companies. And suppose it cost £500,000, that would only be *fourpence* from each of the inhabitants of the United Kingdom—that would be the measure of their risk. And whatever may have been the case in times past, Government business in the present day is just as well, as effectually, and as economically conducted as any private business whatever. Each has its own sphere, and the construction of the *first* telegraph to America, falls within that of Government. We can have as many after, by private enterprise, as private individuals please. Will our Government perceive their duty? Or will they allow themselves to be blindly guided by a principle good enough in the general case, but most detrimental in its operation here. All the chances are that their efforts would be crowned with complete success. But, even were they not, the nation in such matters is always disposed to be very indulgent—and rightly so. But if the matter were rightly gone about, there can be no doubt of entire success. H. K.

Edinburgh, March 9, 1863.

THE STRENGTH OF IRON.

Sir,—In Mr. Colburn's excellent paper upon iron, read before the Society of Engineers, he mentions the fact that five tons per square inch section, whether in extension or compression, is the maximum strain allowed by the Board of Trade for wrought-iron structures. Now this appears to be a great inconsistency, for it is no more or less than a premium for the use of bad iron; whereas, if no limit of strain per inch were specified, but instead, that the maximum load should never exceed a certain proportion of the breaking weight of the iron used in each particular structure (whether 1-3rd 1-4th or as might be determined), then the engineer would have an important interest in procuring first-rate material, for the purpose of saving weight, and a healthy competition for *quality* among manufacturers would be the result. But as anything will comply with the present requirements, price no doubt as a rule governs the quality. Had no such restriction as to strain existed, the discussion as to the safety of Chelsea-bridge chains would never have occurred, as their strength—whether as regards the point at which elasticity begins to be permanently damaged, about 14 tons per square inch, or the breaking strain, about 26 to 28 tons per square inch—will contrast most favourably as compared to many structures about which no question has been raised. H. H. K.

THE PERSIAN GULF CABLE.

Sir,—As the Persian Gulf cable is now under contract, we may expect that before the close of this year England will be in telegraphic communication with India, the Indian system being completed to Rangoon; and as I observe an influential deputation has had an interview with the Chancellor of the Exchequer to ask the Government for assistance in laying a line from Rangoon to Singapore, Java, and China, it may not, perhaps, be premature to consider the route which should be taken in order to connect the Australian colonies with the Anglo-Indian line.

Several schemes have been made public, but Mr. Gisborne's proposal for a cable round the coast, from East Java to Moreton Bay, a distance of 3,021 knots, has been more fully discussed, and has the merit of being more feasible, to a certain extent, than either of the other submarine lines projected.

Now, as Mr. M'Donald Stuart has again successfully crossed the Australian continent (as is well known), reaching the Indian Ocean, and planting a flag a little to the eastward of Cape Hotham, returning by the same route without difficulty, and reporting as favourably as ever of the major part of the country, which he has now traversed three years consecutively, I think it is worthy of consideration whether a direct overland line would not be practicable, commencing at a point on the north coast, nearest the Island of Timor, and passing through Central Australia, thus connecting the sea line with the various systems now in operation.

Mr. Stuart reports that the country is being speedily occupied, and it is stated that stations could be placed within comparatively short and workable distances, in a good pastoral country, with cattle run attached, which would induce persons of the required intelligence to accept the charge, at a moderate remuneration, of keeping the line in working order.

The length of this land section might be some 1,400 to 1,500 miles; the sea line from East Java, *via* Coepang, to the point on the north coast alluded to, about 940—giving a total of about 2,400 miles.

This is the shortest and most direct route that has been proposed, and as the geographical knowledge, which has resulted from Mr. Stuart's exploration, tends to prove the practicability of carrying out the line indicated, I hope it will receive that attention which it appears to be entitled to, when Mr. Stuart's journal comes on for reading at the Royal Geographical Society, which, I observe, is fixed for the 9th inst.

I am, &c.,
March 3, 1863. W. B. Passmore.

THE DENSITY AND RIGIDITY OF THE EARTH.

Sir,—With reference to the communication of Professor Thomson to the Royal Society, the abstract of which is to be found in your number for Feb. 13th, I should be glad if you would make room for the following quotations, which prove that the increasing rigidity of the earth's materials with their distance from its surface, is a fact not by him for the first time set forth.

In a letter of mine to one of your contemporaries, I have observed:—"As the density of the earth increases towards its centre, it must follow that, taken as a whole, the density of any part is greater than that of anything on its circumference. . . . As a proof of its increasing density, there is the fact of its supporting itself, and preserving its shape, which it would not do were its density uniform. A body of uniform density can only support itself within certain limits, thus:—A piece of timber cannot (could not) support itself when produced, *ad. lib.*, both ways. A dew-drop supports its shape and preserves its globularity; but when two or more unite, we have a compressed shape." It is true that the term "rigidity" is not here made use of; but, inasmuch as Professor Thomson apparently considers it to be the result of the enormous pressure, or, which is the same thing, and follows from it, the increasing density of the earth's materials, and not an original greater force of cohesion, which is my case, our views are one; and the fact that to speak of the greater density of a substance rendered denser by compression, but not otherwise denser, necessitates the idea of its increased rigidity, tenacity, or cohesion, proves that this condition is involved in my explanation, whether or not it was considered to be the cause of the uniformity alluded to, concerning which point I am not certain.

I have not the slightest desire to receive any undue credit for the remarks, and freely confess that my illustrations do not clearly make out a claim to the idea in question. Still, you will, I think, allow that the fact of increasing rigidity, resulting from increasing pressure, was here tacitly assumed.

I am, &c.,
J. Alexander Davies.

March, 1863.

"THE STEAM-ENGINE EXPLAINED BY THE USE OF THE INDICATOR."

An error occurred in the letter of Mr. J. Hopkinson, which appeared in our last number. The price of the volume is 12s. 6d., and not 2s. 6d.

Gossip.

The Duke of Somerset has conferred honour on himself by appointing Commander Robert Scott to the "Fisgard." This is a strong evidence of the disposition of the Lords of the Admiralty to promote deserving men. Commander Scott possesses considerable professional and scientific ability; and during the last two or three years he has done as much, if not more, than any man in England to expose false systems of artillery which have been paraded before the public, to promote scientific discussion, and to further the best interests of the country. He has laboured successfully and disinterestedly through the press and in more than one scientific society; and we are glad to know that his attainments, unflagging industry, and high character have been so far appreciated.

Mr. George Parry, of Monmouthshire, in a letter, says:—A distinguished metallurgist, writing to the *Times* in August last, referring to the manufacture of steel, observes: "The processes now in operation are founded on two opposite principles, namely, putting carbon into wrought iron and taking carbon out of pig iron." The latter has been adopted by Mr. Bessemer, the former by me; but both principles are as old as the hills, the improvements being in the mode of manufacture. On the one principle, cast steel, in large masses, from pig iron direct, are produced; on the other, the same from wrought iron—and from both without the use of crucibles. The one requires the careful selection of pig iron from selected ores; the other embraces all kinds of wrought iron, made from any known iron ores, with but rare exceptions. On Mr. Bessemer's principle, the puddling furnace is entirely dispensed with—in mine, its use forms the whole foundation of success. He makes his steel rails direct from pig iron—I manufacture mine from old, worn-out, wrought-iron rails, &c. The first cast-steel rail (a bridge rail) rolled by my process, was made from an old, worn-out wire rope. How could this be done "upon Mr. Bessemer's principle?" Again, upon his principle, pig iron is converted into cast steel without the use of fuel—in my conversion of wrought iron, fuel is used, both in the solid and the gaseous state.

The following letter on "Iron *versus* Wood" has appeared in the *Daily News*:—

"Sir,—As our mutual object is the good of our country, perhaps you will have the kindness to insert the following remarks upon your able article of this day on wood and iron ships.

"My 'proclivities' have been always for iron, but I cannot get over the following objections to that material for powerful fighting vessels of war. I do not include in this description vessels of the 'Alabama' class, which do not require any shot-proof protection, but great speed to enable them to cut up an enemy's commerce and communications, and great lightness and buoyancy to be good and safe sea boats.

"The first serious objection to iron ships for war purposes is, that the shot-hole made through iron plates is rather larger than the shot itself, while that made through wood is more than half filled up again by the elasticity of the wood fibres returning to their original position, any splinters of consequence being torn off from the inner surface alone. The rush of water would be therefore tenfold greater through the iron shot-hole than through the wooden, whilst the latter are also more easily plugged up.

"The second equally great and heretofore insuperable objection arises from the rapidity with which the iron bottom fouls, particularly in warm climates. Now, as speed is one of the cardinal qualities a man-of-war ought to possess, unless large iron vessels have dock facilities for cleaning the bottoms at least every two or three months, it is clear their usefulness as efficient vessels of war must be reduced almost to nothing.

"The third objection is that many wooden ships that have run aground have been saved by parting with their false keels, and so having water enough to float off. This cannot happen to an iron vessel which has no false keel.

"If, as I firmly believe, artillery of gigantic calibre will be used at sea as well as by land, the the danger of shot holes becomes still more imminent when the ship is iron.

"If we take iron as the ship-building material, under such circumstances, we shall then certainly be obliged to use, as I recommended in the Crimean war, for our gunboats, such a quantity of buoyant materials in the construction of the interior of the ships as will enable them to float even if filled with water.

"In speaking of iron vessels, I do not mean the iron shot-proof vessels, but those built of the usual shipbuilding iron plates; the day of the former is now unequivocally passing away by their being no longer invulnerable. "I am, &c.,

"R. G. Sartorius, Admiral.

"United Service Club, March 11."

The engineer of the Cornwall Railway (R. P. Brereton, Esq., of 18, Duke-street, Westminster) has made a report, in which he says:—The works upon the line from Plymouth to Truro continue in good condition, and the permanent way in good working order. At the Saltash station a goods' shed has been erected and open for traffic. At St. Austell a new road and approach to the goods' shed and mileage siding have been completed; a block of stores and siding in connection with them are in course of construction, and will shortly be ready for occupation. A siding and weighbridge have been completed at Burngullow, as also a passenger platform; and a booking-office is about to be commenced. During the last half-year the works upon the line between Truro and Falmouth have proceeded rapidly, and are fast approaching completion. Many of the cuttings are completed. About 680,000 cube yards of earthwork have been taken to embankment, 280,000 of which have been excavated during the last half-year. A total of 35,000 cube yards of masonry has been executed, 19,000 having been completed in the last six months. All the bridges, 35 in number, are, with the exception of four, either finished or in progress. The masonry piers of all the viaducts but Carnon are completed. At this place some little trouble and delay occurred in getting in the foundations in the bed of the river, but several of the piers are now finished, and all the others are proceeding. The superstructure of all the other viaducts has been erected, with the exception of College Wood, at which place the superstructure is in progress, six of the openings having been completed. At the tunnels of Sparnick and Perran, a total of 394 and 319 lineal yards has been completed, leaving only 90 yards and 43 yards respectively to execute. Upwards of a mile in length of railway has been ballasted ready to receive the permanent way. The rails have been delivered, and the other permanent way materials are in course of preparation. The station buildings and goods' shed at Perran and Penryn are in a forward state.

Soldering.—Soldering is the art of uniting surfaces of metals together by partial fusion, and the insertion of an alloy between the edges, which is called solder, it being more fusible than the metal which it unites. Solders are distinguished as hard and soft, according to their difficulty of fusion. Hard solders usually melt only at a red heat, but soft solders fuse at lower temperatures. In applying solder it is of the utmost importance that the edges to be united should be chemically clean—free from oxide—and they should be protected from the air by some flux. The common fluxes used in soldering are borax, sal ammoniac, and rosin. Hard silver solder is composed of four parts of fine silver and one of copper, made into an alloy and rolled into sheets. It is quite difficult of fusion. Soft silver solder is composed of two parts of silver, one part of brass, and a little arsenic, which is added at the last moment in melting them. It will be understood that these alloys are commonly run into convenient bars or strips for use. Silver solders are used for soldering silver work, gold, steel, and gun-metal. A neater seam is produced with it than with soft solder. It is commonly fused with the blow-pipe. A strip of thin silver solder is laid on the joint to be closed, the blow-pipe is brought to bear upon it, when it melts and runs into the joint, filling it up completely. Button solder is employed to solder white metals, such as mixtures of copper and tin. It is composed of tin ten parts, copper six, brass four. The copper and brass are first melted, then the tin is added. When the whole is melted the mixture is stirred, then poured into cold water and granulated, then dried and pulverised in a mortar for use. This is called granulated solder. If two parts of zinc are added to this alloy, it makes a more fusible solder. Fine gold cut into shreds is employed as a solder for joining the parts of chemical apparatus made of platinum. Copper cut into shreds is used as a solder for iron. Hard silver solders are frequently reduced to powder, and used in that condition. Soft solder consists of two parts of tin and one of lead. An excellent solder is made of equal parts of Banca tin and pure lead; it is used for soldering tin plate, and, if well made, it never fails. The following is a useful table of solders with their fusing points:—

No.	Parts of Tin.	Lead.			Melting deg. F
1	1	25			558
2	1	10			541
3	1	5			511
4	1	3			482
5	1	2			441
6	1	1			370
7	1½	1			334
8	2	1			340
9	3	1			356
10	4	1			365
11	5	1			378
12	6	1			381
13	4	4	1	Bismuth	320
14	3	3	1	,,	310
15	2	2	1	,,	292
16	1	1	1	,,	254
17	1	2	2	,,	236
18	5	3	3	,,	202

The alloy No. 8 is used sometimes for soldering cast iron and steel; the flux used for this purpose is sal ammoniac, but common resin may be employed. Gold and silver are sometimes soldered with pure tin and a flux of resin. Copper, brass, and gun-metal are soldered with No. 8 and a flux of resin or sal ammoniac. The chloride of zinc is used for soldering sheet and plate iron as a flux with the same solder. Lead and tin pipes are soldered by plumbers with Nos. 6, 7, and 8, and a flux of resin and sweet oil. In soldering with soft brass, the ends of the article to be soldered are secured together by a wire, and granulated solder and powdered borax are mixed in a cup with a small quantity of water, and spread along the joint with a spoon. The article is then placed in a clear fire, and the solder melts at a bright red heat, when the article is then removed from the fire. In soldering small articles with the blow-pipe, they are supported on a piece of charcoal, or, what is better, pumice-stone, and the flame is ejected upon the solder. In soldering lead pipes, the parts to which the solder is not to be attached are usually covered with a mixture of lamp-black and size. In soldering any articles care must be exercised to have the edges of the plates or articles perfectly clean, or the solder will not adhere. A flux is employed for the purpose of preventing oxidation. Resin and sal ammoniac, powdered and mixed together, make a good flux for copper and sheet iron soldering. In other cases, a strong solution of sal ammoniac is used to moisten the edges of the joint. Then the resin is sprinkled upon it, and the solder applied. The chloride of zinc is made by dissolving pieces of zinc in muriatic acid. It is well adapted for soldering zinc plates and pipes, and is applied with a brush to moisten the edge of the article to be soldered. The solder is then applied in the usual way with a tool. Zinc is a very difficult metal to solder, because it is so easily coated with oxide, and it also volatilises with heat.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c.—*none.*
Boilers and Furnaces, 2257.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2264, 2278, 2290, 2297.
Ships and Boats, including their fittings, 2274, 2276, 2280, 2287, 2301.
Cultivation of the Soil, including agricultural implements and machines—*none.*
Food and Beverages, including apparatus for preparing food for men and animals, 2294, 2296.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2270, 2291, 2304.
Buildings and Building Materials, 2258, 2261, 2263, 2272.
Lighting, Heating, and Ventilating, 2285, 2300.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2260, 2271, 2279, 2282, 2284, 2286, 2302, 2305, 2306.
Metals, including apparatus for their manufacture, 2266, 2293, 2303.
Chemistry and Photography, 2265, 2275, 2277.
Electrical Apparatus—*none.*
Warfare, 2281.

Letter-Press Printing—*none.*
Miscellaneous, 2256, 2259, 2262, 2267, 2268, 2269, 2273, 2283, 2288, 2289, 2292, 2295, 2298, 2299.

2256. C. A. Wheeler. *Improvements in machinery for perforating paper.* Dated August 12, 1862.

This invention consists in a hand-power perforator, and relates more particularly to portable or hand perforating machines for the table, shop, warehouse, or counter, as herein described. It is not, however, intended to restrict the application of the principle to the portable or hand form, as the rotary disc perforator and plain flat-surfaced bed-plate (which constitute two of the main features of the said improvements), as well as the peculiar construction of the gripping and riding frame (which forms a third feature of the invention) can be applied in the formation of similar machines of almost any capacity required, and which larger machines, when fitted with suitable gearing, may be worked by steam or other power. It is also intended to apply the same combined principle of construction as regards the rotating perforator or cutter, and gripping and rising guide frame, which answers the double purpose of holding the paper or other material securely in the required position for being perforated or cut, while it also acts as a guide for the rotating perforator for perforating or partially or wholly severing paper, cloth, and other fabrics or materials, whether in single sheets, laminæ, or folds. *Patent completed.*

2257. A. Delrue. *Improvements in compositions for preventing and removing incrustations in boilers.* Dated August 12, 1862.

These compositions are composed entirely of vegetable matters, and are prepared by dissolving or infusing in hot water the bark of the oak and pine, as well as the leaves of the sumac tree, ground and reduced to the state of a coarse powder. This decoction is concentrated to a density of about 10 deg. Beaume, and to it is added a quantity (say 15 to 30 per cent.) of cream of tartar (bitartrate of potassa) and spirit of turpentine. *Patent completed.*

2258. C. M. Westmacott. *Improvements in cements.* Dated August 12, 1862.

For the purposes of this invention, lime is combined with unburnt limestone or chalk suitably ground or reduced to powder. The proportions may be varied; but when using very good lime, it is preferred to use at the rate of two measures of unburnt chalk or limestone to one measure of lime. This compound may be employed alone or combined with sand, plaster of Paris, clay, or other materials, according to the circumstances under which it is to be used. *Patent completed.*

2259. J. Langran. *Improvements in apparatus for driving agricultural machinery.* Dated August 12, 1862.

In carrying out this invention, the inventor proposes to construct a strong framework, and to arrange in the centre of the same, in suitable bearings, a vertical shaft, the lower extremity of which is furnished with a large horizontal cogged wheel, into and underneath which a small bevel toothed wheel gears, being attached to a horizontal shaft working in bearings in the frame, and passing through the sides thereof to some distance, in order that it may be worked by a horse travelling in a circle, and turning by means of the ordinary machinery—a shaft and cogged wheel gearing into a corresponding wheel on the outer extremity of the horizontal shaft. The vertical shaft in the apparatus is furnished at its upper end with a horizontal bevel toothed wheel, into which four or more vertical bevel toothed pinions gear and operate, horizontal driving shafts passing through bearings set in standards of the framing, the ends of these shafts having driving pulleys keyed thereon, from which straps or bands may communicate motion to agricultural machines arranged in contiguity to the apparatus. A casing may be constructed on the framework so as to enclose the apparatus and protect it from the weather, leaving only the driving pulleys exposed. *Patent abandoned.*

2260. F. J. Leblond. *Improvements in sewing machines.* Dated August 12, 1862.

These improvements consist in means of sewing by the same machine—firstly, the shuttle or lock stitch; secondly, the chain stitch with one thread; thirdly, the same stitch with two threads. *Patent abandoned.*

2261. A. B. Childs. *Improvements in machinery for cutting veneers.* (A communication.) Dated August 12, 1862.

For the purposes of this invention, the log or block from which the veneers are to be cut is firmly secured to a bed-plate, by means of bolts which pass through the bed-plate and screw into the log or block. The bed-plate is perforated with holes at equal distances apart, and a sufficient number of them to receive a requisite number of bolts to hold the block firmly thereto. The bed-plate may be placed in a vertical, horizontal, or a diagonal position, but it is preferred to place it in a vertical position. The bed-plate, together with the block carried thereby, has a motion up and down a distance somewhat over and above the width of the largest block to be cut, and this motion is, by preference, communicated to it by means of two cranks and two connecting rods, one at each end of the bed-plate. The knife when making the cut is stationary, but is capable of being moved towards and from the bed-plate by the action of the feed motion, which, by means of a double ratchet, causes it to recede immediately after the cut, and again to move forward immediately before the cut a distance depending on the thickness of the veneer next to be cut. The knife consists of a straight cutting edge, with one side bevelled off, and is firmly secured to a knife-block, which is made to slide towards and from the bed-plate. A little before the edge of the knife there is a pressure-bar made adjustable by set screws, and bolted firmly in its required position to a pressure-beam. The invention also consists in the method of feeding the knife, and of graduating the feed to the different thicknesses of veneers to be cut. By this method the patentee is enabled to cut veneers more perfectly and sound, and more free from cracks, from any kind of wood, and to any thickness required. *Patent completed.*

2262. C. Sengry. *An improved smoking pipe, which may also be adapted as a tube for smoking cigars.* Dated August 12, 1862.

The patentee claims—first, the employment of a stem or tube, bent, curved, or inclined downward at one end, and communicating with the bowl, and with a detachable hollow ball, or otherwise-shaped chamber or recess, in the manner and for the purpose described; second, the mode of rendering the bowl removeable by fitting it on a pin, fork, or tongue, so as to be readily taken off and replaced, as described. *Patent completed.*

2263. G. Sanders. *Improvements in domestic fire-escapes.* Dated August 12, 1862.

In carrying out this invention, the patentee employs a chain ladder formed of two chains, in which are disposed, at distances of eight or nine inches, small plates, constituting links or parts of the chain, in which plates the ends of the steps of the ladder are fixed. A ladder so formed is very flexible, may be packed in a small space, is easily handled, and may be used as an escape from a house on fire, or for ascending or descending from a house window for other purposes. In order that it may be readily and safely available as a fire escape, he disposes it in a box immediately under the window of the apartment from which it is to be used; in the bottom of this box the upper ends of the chains are to be securely fixed, and the box is to be fixed to the floor and joists, or the ends of the chains may be at once fixed through the joists of the flooring. To the outer ends of the chains he attaches spring hooks, which, when the chain is thrown out of the window, are to be hooked into eyes previously fixed below the surface of the paving in the street, and at such a distance in front of the house as to be as clear of the fire as possible. The eyes in the street are affixed in position at the time of placing the fire escape in position in the house; and in order that they may be readily formed at any time in an emergency and kept in order, he sinks such eyes below the surface as before mentioned, and applies metal plates, in the manner of coal cellar plates, to protect them. In order that it may run out of the window freely, he disposes a roller mounted on the window sill, which may be at a suitable height, and also project from the window, to run the fire escape free it may be of a balcony below. *Patent completed.*

2264. J. Bower. *Improvements in railway sleepers.* Dated August 12, 1862.

This invention relates to a new form of iron railway sleeper, which it is proposed to make with a V shaped section, with a flange at the top of each arm, to which flange the rail is to be fastened with bolts or otherwise, whilst the angular base of the sleeper will rest in ballast in the usual way. *Patent abandoned.*

2265. J. Dickson. *Improvements in the manufacture of chlorine for commercial purposes.* Dated August 13, 1862.

In the manufacture of chlorine, according to this invention, aqueous solution of chloride of sodium, common salt, sea water, hydrochloric acid, the chlorides of iron, and other suitable chlorides, are heated and subjected in a decomposition cell to the influence of a current of voltaic electricity, whereby they are resolved into carbon at the carbon or other anode employed, while their other elements are transferred to the carbon or other cathode employed in the said decomposition cell. To separate the products of the said voltaic decomposition, the inventor employs a porous medium or mediums, although in some instances he can dispense with porous mediums. In effecting the said voltaic decomposition of the materials alluded to, he adds to the negative compartment of the said decomposition cell any suitable acid, oxide, salt, or substance which will assist the evolution of the chlorine at the anode employed. Some of the said substances, which he adds to the said negative compartment, are either nitric, nitrous, sulphurous, or sulphuric acid, or oil of vitriol, sesqui-chloride of iron, sulphate or chloride of copper, peroxide of iron or of copper. Or he obtains oxygen, either by the voltaic decomposition of acids and salts which do not contain hydrochloric acid, or by the decomposition of alkalies in the said decomposition. *Patent abandoned.*

2266. J. Dickson. *Improvements in obtaining sodium from certain sources of that metal.* Dated August 13, 1862.

This invention is carried into effect by subjecting common salt to the action of a current of voltaic electricity, applied thereto in suitable vessels, by means of carbon or other suitable anodes and cathodes immersed therein. Or the inventor subjects to similar treatment caustic, or anhydrous soda, or suitable salts of soda, when fused in suitable vessels. *Patent abandoned.*

2267. J. Cooper. *Improvements in valves and buckets for pumps, and in valves or cocks for other uses.* Dated August 13, 1862.

This invention, in so far as it has reference to buckets for pumps, consists in forming the ordinary leather packing of the bucket by binding a strip of leather round the metal, and securing it by pins passed through holes in the metal, the points or inner ends of such pins being turned down after insertion, and the leather being bevelled so as to keep the heads of the nails within the circumference of the leather packing. And this arrangement is in substitution for the ordinary mode of "cupping" the leather, and applying it to the metal by screws. And the invention, in so far as it has reference to valves or cocks for other uses, consists in the combination of the valve and seating above referred to, and in fixing the same in the tap, so that the pressure of the fluid at the inlet shall have a tendency to close the valve against the seating, the valve being opened from the seating by means of a screw or a ball lever. *Patent completed.*

2268. J. Smith and J. S. Rayment. *Improvements in apparatus for generating steam and for regulating its flow.* Dated August 13, 1862.

For the purposes of this invention, the inventors make use in the furnaces of boilers employed for the generation of steam, either of a novel form of notched fire-bar, capable of being put in motion for the purpose of rapidly and effectually breaking up any clinker that may be formed upon them; or otherwise they employ for that purpose in connection with stationary bars, a description of mechanical pricker so arranged as to enable the clinker to be rapidly and effectually broken up, so as to maintain a thorough and clear draught through the fire. For creating a draught through the bars they make use of the waste steam from the engine in such manner as to do away with the noise and irregular action upon the ordinary blast pipe arrangement. The flame and products of combustion upon leaving the boiler are further utilized by being made to pass between an arrangement of chambers through which the feed water circulates before entering the boiler. For regulating the flow of steam from the boiler, as also for regulating the admission of water thereto, and for "blowing off," the inventors employ a form of tap or cock not liable to become set fast when its parts are expanded by heat—a cause of great inconvenience with ordinary taps or cocks under like circumstances. *Patent abandoned.*

2269. J. R. and F. C. Tussaud. *Improvements in the treatment of representations formed from wax, or from compositions of wax with other matters.* Dated August 13, 1862.

The object of these improvements is to protect the surfaces of such matters by the application thereto of a coating adapted to prevent the injurious effects of atmospheric influences, and to admit of repeated cleansing thereof without the necessary disturbance of surface tints or colours. For this purpose, when the desired forms have been obtained, and any needful colouring or tinting has been applied thereto, the patentees apply to the surface thereof a coating of a suitable varnish, such as a solution of shellac, gelatine, or albumen, or white, hard, or orher varnish, preferring those varnishes which are comparatively colourless; and then in order to neutralize the glossy or shiny effect of such coating, they apply thereon one or more coatings of wax, stearine, spermaceti, or of other similar solid fatty oleaginous matters, or of the composition of which the representation is formed dissolved in benzole or other suitable solvent. *Patent completed.*

2270. C. W. Smith W. Mould, S. Cook and W. H. Hacking. *Improvements in looms for weaving.* Dated August 13, 1862.

The objects of this invention are effected—1, By an improved taking-up motion for the purpose of giving any desired number of picks to the inch, without the aid of the usual emery roller. 2, Of a positive break or strap motion, which also stops the loom in any given place. 3, By a compound weighting lever, which dispenses with three-fourths of the weight ordinarily used. *Patent abandoned.*

2271. W. L. Boyle. *Improvements in the construction of chairs and foot-stools for the use of dentists, and in chairs, couches, and beds for invalids.* Dated August 13, 1862.

In adapting the first part of this invention to dentists' chairs, the patentee attaches the back to the body of the chair by hinges at or near its lower end, and he connects the back to the arms by means of straps of leather, or by chains at both sides of the chair. These straps or chains are to be fastened by one of their ends to the arms of the chair, and by their other ends to spring rollers, or to a roller shaft concealed in the back of the chair at about the middle of its height. Upon this roller shaft is placed a notched or ratchet wheel, with a spring pawl taking into it, so as to hold it in any desired position. The head-rest is also attached to the back of the chair by a hinge or hinges of a novel construction, provided with a spring catch, whereby the head-rest may be retained in any desired position. The second part of the invention relates to a system of jointed rods or levers, together with a screwed shaft with right and left handed threads, or other mechanical means for working the levers, and thereby raising or lowering the seats of chairs or the frames of couches or beds in a perfectly vertical line. This arrangement of levers and right and left handed screws, may also be applied for raising the frames of couches and beds for the use of invalids. The third part of the invention relates to foot-stools, and consists in a simple method of altering their altitude and inclination; to which end the foot-stools are composed of two halves of a box of any suitable shape, but capable of sliding one within the other. A tendency is given to the inner one to rise by the pressure of springs contained within it, whenever the ends of certain spring levers or pawls are withdrawn from a rack or ratchet attached to the inside of the upper half of the box. The invention cannot be fully described without reference to the drawings. *Patent completed.*

2272. J. Peters. *Manufacture of hydraulic cement.* Dated August 13, 1862.

This invention relates to a certain compound for making hydraulic cement, and consists in burning in a kiln grey stone containing about 16 per cent. of clay, and 84 per cent. of carbonate of lime, and two parts of pebbles from the sea beach, or any other like stones containing about 90 per cent. of silica and 10 per cent. of clay. When burnt, they are pulverized or ground to a fine soft powder, which forms a cement ready for use. When water is added on using this cement, the lime and silica combine and become extremely hard. *Patent abandoned.*

2273. H. Twelvetrees. *Improvements in rat and mice traps.* Dated Augnst 13, 1862.

This invention consists of a long-shaped box, made wholly, or in part, of wood, zinc, tin, galvanized iron, wire, or other suitable material—that for mice being about 9 in. long by 3½ in. wide, and that for rats about 24 in. long by 8 in. wide. At one end of this box is mounted a flat tin, iron, or wood board, termed a balance board, and upon this is fixed an inclined plate, moving beyond the vertical position in either direction, and extending from side to side of the trap. Immediately above, and coincident with, the central balance of this board are two holes cut in the sides of the trap, and so disposed that, when the balance board is not acted upon, the raised inclined plate is in the same line as the two corresponding sides of the holes, and when a mouse or rat enters upon the balance board, and moves a little out of the centre thereof, as the end is depressed with the weight of the animal, the slanting plate falls in a line with the other sides of the entrance holes, thus preventing his return, and compelling him to go forward into the body of the trap. Underneath the balance board is fixed a plate of tin, or iron, extending between the two sides of the trap to prevent the vermin from making their escape in that direction. By preference, the patentee allows the whole, or a portion, of the width of the entrance holes to be left open across the top of the trap, so that the vermin may enter either at the top or at the sides. He also forms the entrance end of perforated zinc or open wirework, and inside this end of the trap, upon the surfaces which can be seen through the openwork end, he fixes some corn seeds, or other bait. Inside the trap, at the end of the balance board which falls down, he disposes a tin, iron, or zinc plate, from side to side; upon this plate he fixes some small hooks, for attaching suitable food, to act as a bait for the vermin, and thus they are compelled to step upon the balance board to reach the bait; the instant they move out of the centre thereof the end falls down with their weight, and, finding they cannot return, owing to the slanting plate having closed the entrance holes, they pass forward, and the same instant the balance board returns to its original position. *Patent completed.*

2274. G. Turner. *Improvements in fastening armour plates of ships.* Dated August 13, 1862.

In fastening the armour plates of ships, the inventor prefers to form the plates with two longitudinal ribs throughout their length, such ribs to be some little distance from the edges of the plate, and of about 4 in. in breadth, and 1 or 2 in. in thickness, that is to say, they project about 2 in. from the back surface of the plate. In these ribs he bores holes for the reception of the bolt ends or heads; these holes being bored from the inside, and sunk to about the thickness of the rib, do not enter the general substance of the plate, or detract from its strength. The plates may be of 3, 4, or 5 in., or of other suitable thickness. The holes so bored he undercuts, that is to say, enlarges inwards, to a conical form the shape which the bolt head or end is made to assume. Instead of ribs being formed on the plates, bosses or thickness pieces may be welded on in the positions required for the bolts, or the undercut holes or recesses may be made in the body of the plate itself, but this somewhat weakens the plate, which it is better to avoid. In this case he sinks the holes about 1¼ or 1½ in. in depth. The ship's side being prepared to receive the ribbed plates, that is, with grooves into which the ribs fit, the bolts are driven through from the inside, the bolt being a rod of iron fitted with a screw or other means of fastening inside the ship, while the head part has cross saw cuts made in it, but which otherwise is of the form of the round bar of which it is formed. For inserting the bolt, the point of a cross wedge is inserted in the saw cuts, and fixed there by a small pin; the bolt is then driven through the ship's side into the recess or hole in the plate, the cross wedge retains its position until it comes in contact with the bottom of the hole, where it stops, and the bolt is further driven home, so that the cross wedge opens out the saw cuts and swells the end of the bolt out to fill the enlarged internal form of the hole, and assuming a conical form therein, it cannot again be withdrawn, as any force applied to draw it out brings the wedge with it, and so keeps the bolt end of the enlarged conical form it has assumed. The bolt so inserted and fixed in the plate is then screwed up by its nut, or otherwise fixed, and so on the several bolts are inserted throughout the area of the plate. The projecting ribs or bosses when made on the plate remove all its weight from the bolts, which, in that case, have no other strain than that necessary to hold the plate against the ship's side. Instead of a cross wedge a single wedge might be used, but would not be so well adapted for the purpose required. The plates fitted and secured according to this invention, may be further tongued and grooved together as in ordinary. *Patent abandoned.*

2275. L. D. Verstraet and E. M. Olivier. *Improvements in manufacturing carbonate of soda.* Dated August 13, 1862.

The patentees claim—1, The formation of carbonate of soda by transforming sulphuret of sodium into bicarbonate of soda, whatever may be the manner in which the sulphuret of sodium is obtained, as described. 2, The employment of lime or other oxydated agent capable of answering similar purposes. 3, The arrangement of furnace and other apparatus represented in the drawing. 4, The formation of carbonates of potash and soda by transforming sulphurets of potassium and sodium into bicarbonates of similar bases. 5, The preparation of sulphurets of potassium and sodium by the decomposition of sulphuret of barium. 6, The manufacture of sulphate and carbonate of baryta in a similar manner. 7, The application of a gas apparatus of any suitable form for producing the combustion of the hydro-sulphuric acid, and for transforming it into sulphuric acid. 8, The use of steam for quickening the reactions. 9, The entire apparatus, which may be of any suitable form and arrangement, for the transformation of the sulphuret of barium into carbonate, and also for producing the combustion of the hydro-sulphuric acid, in order to transform it into sulphuric acid, and also the various modifications and improvements therein necessary for producing the desired result. *Patent completed.*

2276. L. Galli. *Improvements in apparatus for propelling vessels.* Dated August 13, 1862.

This propeller consists of two paddles, which are placed below the water line, and, by preference, near the stern of a ship, and which are moved to and fro in the direction of the length of the vessel. They are jointed to a metal frame which is moved to and fro in guides in a slot or rectangular opening in what is called the "dead wood;" this movement is given to the frame, and so to the paddles, by a hollow rod or shaft reciprocating in the direction of the length of the keel. The stroke of the shaft when in motion is proportioned to the size of the ship, and is effected by means of a crank and connecting rod, which are adapted to the engine. The paddles are open, so as to project from the sides of the keel when they are going in the direction opposite to the intended movement of the vessel, and shut so as to be within the opening in the keel in the return movement. The shutting and opening of the paddles is effected a few moments before the change of the direction of these movements by two rods which pass through the hollow shaft, each paddle being connected to one of the rods. When it is desired to reverse the direction in which the vessel is propelled, the paddles are (by the rods which pass through the hollow shaft) caused to be open when the shaft is moving in the direction in which it was moving when they were before shut, and to be shut when they were before open. *Patent abandoned.*

2277. W. Schnell. *Improvements in extracting the sulphur or sulphurous acid from the oxy-sulphuret of calcium which is contained in the residues or waste material obtained in the manufacture of soda.* Dated August 13, 1862.

The waste material is, in carrying out this invention, moistened with water, and then spread out upon great hurdles superposed one upon another, in the same manner as those used in a common drying room. The principal condition is the unrestrained access of air combined with some steam, water, and carbonic acid, if this is to be found. The material remains upon the hurdles for about two or three weeks (but not more than a month); after removing it from the hurdles it is washed out (in an apparatus fit for the purpose) with water never exceeding a temperature of thirty to forty centigrade (of Cilsius), and a solution of hyposulphite is thus obtained. When this solution has been removed, the material is again spread out upon the hurdles, and after the required time washed out again till no more hyposulphite will be found. Treated in this way, the residue or waste material acquires more weight during its stay upon the hurdles. This augmentation of weight is equal to the whole weight of the hyposulphite formed; and it results therefrom that, if the waste material contains 5 per cent. of sulphur to be gained from the hyposulphite, the weight of the sulphur is equal to 6 per cent. of the primitive weight of the waste material used; after having repeated the above-named process twice, the inventor has therefore obtained 12 per cent. of sulphur. The hyposulphite of calcium thus obtained must now be decomposed, and this will be done by using muriatic acid in the following manner:—The solution of hyposulphite is boiled in an iron boiler, and while boiling the muriatic acid is to be added by degrees, and the solution kept boiling till the sulphur is separated from the sulphurous acid, which is then let off, and the sulphur will be found at the bottom of the boiler in a pure state. If he wishes to obtain sulphur alone, the hyposulphite of calcium is evaporated by heating till dry, and then distilled by heating in iron retorts. By thus proceeding he obtains half the sulphur contained in solution, and the residue remaining in the retorts contains a mixture of sulphite of calcium and sulphuret of calcium. If he wishes to obtain sulphurous acid only, the solution, when evaporated as before, is to be heated in furnaces with air unrestrained access of air, and half the sulphur which the solution contains is obtaining as sulphurous acid, and the residue left in the furnace is entirely composed of sulphate of calcium. *Patent abandoned.*

2278. J. H. Johnson. *Improvemnnts in carts and other vehicles.* (A communication.) Dated August 13, 1862.

This invention relates to certain improvements in carts and other vehicles, with the view of making them capable of weighing their own loads. According to this invention, the body of the vehicle is made independent of the framing when weighing a load, and solid with it when simply transporting the load. Toward the back of the framing there is, according to one arrangement, a transverse shaft, to which a forked lever is attached, and this lever, at its fore end, presses during the process of weighing upon one arm of a Roman balance placed in front of the vehicle, and attached thereto. Regulating screws, attached to the framework, are made to support the body during transit, but when the operation of weighing is to take place these screws are lowered, and the body of the vehicle is then thrown upon the forked lever, which acts, as before mentioned, on the weighing apparatus. *Patent completed.*

2279. E. J. Dagnal. *Tray or receptacle adapted for washhand stands for holding tooth brushes, tooth powder, and nail brushes.* Dated August 14, 1863.

This invention is designed to prevent the unpleasant odour which tooth brushes acquire when kept in a covered box or tray of the ordinary kind. It is, by this invention, proposed to effect this object by so making a tray or receptacle that the tooth brushes shall stand upright therein, somewhat similar to an umbrella stand; a recess is formed therein to contain tooth powder, and a cover is adapted thereto. The lower part may be used to hold a nail brush. Trays or receptacles constructed on the above plan may be made very ornamental, of various devices, in porcelain, glass, or other material, or a combination of materials. *Patent abandoned.*

2280. A. Walker. *An instrument to determine or ascertain the depth of water and the distance a ship has run.* Dated August 14, 1862.

This invention consists of a tube which surrounds, or partially surrounds, an archimedean screw, or one, two, or more fans, or a wheel like the paddle-wheel of a steamboat, or any other suitable revolving power communicator which is capable of being actuated by water passing through the tube, and which is connected with a train of indice wheels, enclosed in a case, placed on the outside of the tube, and which indicate the distance a ship has run and the depth of water sounded. When the instrument is used for sounding, a weight is attached to the bottom of the tube to facilitate the sinking thereof. The propeller inside the tube revolves by reason of the action of the water, passing up through the tube, acting against the blades of the propeller, and, when used as a log, by being drawn horizontally through the water by the velocity of the ship. In the latter case the weight is dispensed with. The quantity of water acting upon the propeller may be regulated by the size (diameter) of the tube, or by the size of the screw, or other form of power communicator. *Patent completed.*

2281. J. Irvine and J. W. Hand. *An improved rifle rest.* Dated August 14, 1862.

This invention is carried out as follows:—A trough of wood, lined with india-rubber, is fixed on a ball and socket joint, which ball and socket joint is mounted on a vertical rack, the rack sliding in a hollow pillar, or upright, fixed on the base of the instrument. The trough of wood is of a shape proper to receive and support the rifle from the lower band to the trigger-guard, and the rifle is fixed in the said trough by means of a screw on one side, which screw carries at its end a spring which, by the action of the screw, is made to press against the rifle, and bind it tightly on the trough. The ball and socket joint is provided with a clamp screw, for fixing it in any required position, and the rack, which carries the ball and socket joint and trough, is raised and lowered by means of a pinion in the pillar, or upright, which pinion is worked by a handle on its axis. The rack is also provided with a clamp screw, so as to fix it in the required position, as well as a pall, or click, which engages in the teeth of the rack, and prevents the descent of the rack after it has been lifted by the pinion. The said pall, or click, can be disengaged from the rack by pressing on a thumb-plate when it is required to lower the said rack. The pillar, or upright, is connected to the base, or platform, by strong iron stays and bolts, and the platform is made to fold up and form a box, in which the pillar and other fittings can be packed. In using this new or improved rest, the rifle is placed in the trough by means of the screw and spring before described. The elevation and direction of the rifle are adjusted by means of the ball and socket joint, which is fixed by its clamp screw, and the rifle is raised or lowered to the required height of the shoulder of the shooter by means of the pinion and rack, and the rack afterwards fixed by its screw. The rifle may be fixed and adjusted in our rifle rest in a few seconds. *Patent abandoned.*

2282. J. Key and E. Hoskins. *Improvements in plain and ornamental metallic pillars for bedsteads, cots, couches, &c.* Dated August 14, 1862.

In carrying out this invention, the inventors make a mould in cast iron, or other suitable material, the said mould having internally the figure of the ornamental pillar to be made. The mould is made in two or more pieces. They place a rod or tube of iron, or a plain pillar, in the axis of the mould, and pour into the mould plaster of Paris, or other mixture or composition which will dry or set hard. There is thus made a core, which they place in another mould of the same figure as that in which the said core was made, but somewhat larger in diameter. They then pour melted metal into the last-described mould, so as to fill up the space between the mould and the core with the melted metal. A hollow metallic pillar, having the same ornamental figure as the interior of the outer mould, is thus produced. In making plain metallic figures according to this invention, they proceed in the manner described with reference to an ornamental pillar, excepting that they use moulds having a plain instead of an ornamental figure. *Patent abandoned.*

2283. G. Welch. *Improvements in inkstands, metallic pens and penholders, and other instruments and appliances used in writing and marking.* Dated August 14, 1862.

We cannot here give space to the details of this invention. *Patent completed.*

2284. C. E. Wilson. *Improvements in buskle fastenings for braces and belts.* Dated August 14, 1862.

This invention consists in forming a box or hollow case on the bottom of the flap of the buckle, to receive a spring catch formed in a piece with or fixed to a plate to which the brace ends, in the case of braces, or one end of the belt, in the case of belts, are, or is attached. Instead of unbuttoning the tabs on the brace ends, as at present, the brace is released by withdrawing the spring catch from the case on the buckle flap. The brace is attached by simply inserting and engaging the catch in the case. *Patent abandoned.*

2285. W. Beatson. *Improvements in stoves.* Dated August 14, 1862.

This invention consists in constructing drawing-room and other stoves with the inner arch and cheeks, together with the brick or other back and the bottom grate and the doors into the chimney, moveable, either separately or two or more of such parts together, being those parts which are liable to be injured or blackened by the action of the fire. The removal is effected without the necessity of moving the stove from the chimney-piece. The object of the invention is to afford more ready access to the chimney, for the purpose of affixing or refixing and sweeping or repairing the said stoves; also to enable the aforesaid parts to be taken out when the fire is not required, and to have bright or ornamental parts substituted or placed in front of the parts blackened by the fire, without removing the parts so blackened. *Patent completed.*

2286. G. White, F. Buckland, and C. Rees. *Improvements in water-closets.* Dated August 14, 1862.

For the purposes of this invention, the basin of the closet—which may be made either of glazed pottery, earthenware, enamelled iron, or other suitable material—is constructed with the bottom of a concave form, so as always to retain it in a sufficient quantity of water. The basin is constructed nearly of the same width at the bottom as at the top, and the sides being thus nearly perpendiular to the water's edge, are not liable to be fouled by offensive matter dropping and lodging upon them, the deposits in the basin falling into the water at the bottom. The outlet from the basin is made by an aperture at the side, at such a distance from the bottom as to retain the necessary quantity of water, while the inlet admitting the water from the cistern is placed opposite the discharge aperture, and the quantity of water admitted is regulated by a fan, so shaped as to cleanse the basin thoroughly by allowing a portion of the water to be driven on each side of the basin, instead of being carried with a spiral motion round it, as is usually the case, whilst the bulk of the water flows across the bottom of the basin into the discharge pipe. The basin is trapped by means of a syphon or trap in the usual manner. The closet is so constructed by means of a suitable combination of rods and levers connected with the seat and service box as be self-acting on every occasion of the closet being used, and thus preventing the possibility of use without the removal of the contents of the basin, as hereinafter described. *Patent completed.*

2287. D. P. Marques. *Improvements in apparatus for cleaning the bottoms of ships.* (A communication.) Dated August 14, 1862.

This apparatus is formed of two metal foundation plates, one of which supports two cylinders and pistons, the other being provided with a strong brush or scraper. These plates contain also a space enclosed by a sheet of india-rubber or gutta-percha, which space communicates with a force-pump on the deck of the vessel by means of india-rubber tubes. The piston-rods from the cylinders are attached to the brush or scraper, and the cylinders are supplied with compressed air from the pump by means of tubes, by which means a lateral reciprocating motion is given to the brush or scraper, which is pressed firmly against the sides of the vessel by means of the pressure of air in the space enclosed by the india-rubber. *Patent completed.*

2288. H. R. Passey and L. Niman. *Improvements in cigar tubes or holders.* Dated August 14, 1862.

This invention consists of an improved tube or holder for cigars, by the use of which the cigar may be smoked without being brought in contact with the mouth or fingers, and whereby the cigar may be extinguished at any time, and transferred to the pocket or the travelling case perfectly enclosed in the tube, and incapable of imparting an unpleasant odour to any contiguous articles. *Patent abandoned.*

2289. J. Petrie, jun. *Improvements in apparatus for blowing and exhausting air.* Dated August 14, 1862.

In carrying out this invention, the inventor adopts fixed blades between fixed surfaces, leaving the circumference open for the passage of air, which is drawn through a central aperture. The revolving blades he mounts upon a shaft having a bearing on one side only, and extending through one of the fixed surfaces, which surface is formed upon or is carried by the pedestal constituting a bearing for the shaft. Also he adapts fixed vanes outside the revolving vanes extending concentric therewith. *Patent abandoned.*

2290. W. J. Curtis. *Improvements in apparatus for ascertaining the fares and earnings of public vehicles.* Dated August 14, 1862.

In adapting this invention to a cab or omnibus, the inventor provides a packet of cards, having on their face a graduated dial, numbered and representing distances in miles, half miles, and quarter miles, if necessary. Each omnibus passenger or hirer of a cab will receive one of these cards on entering a vehicle, it having been pierced by a punch to indicate a starting point on the dial. On leaving the vehicle, the card is to be again pierced, and the distance between the two nicks in the card will show the distance traversed. The punch will, however, when making the second nick which indicates the termination of the passenger's journey, strike out a portion of the card, and discharge it into a receiver, which is accessible only to the proprietor of the vehicle. This punched out portion will have a counterpart of the nicks retained by the passenger, and will, therefore, show the amount of the fare chargeable to the passenger. *Patent completed*

2291. J. Hopwood. *Improved apparatus used for collecting fibrous material and dirt from the carriage boards and roller beams of mules and other similar machines used in spinning.* Dated August 14, 1862.

In carrying out this invention, the patentee employs a roller, or series of rollers, extending along the carriage board, revolving in contact therewith, while the carriage is running out, but kept clear therefrom when the carriage is running in. This change is effected by mounting the said rollers upon levers turning on centres at the back of the roller beam, and connected to other levers, which are fixed to a line shaft, extending along the width of the mule. One or more of these last-mentioned levers carries a roller, which, when the carriage is running out, moves beneath an inclined plane, which inclined plane then turns upon a centre, so as to allow the said rollers to pass on to its upper side, and thus the line shaft is caused to turn and elevate the cleaning rollers. To the levers which carry the cleaning rollers he adapts arms extending upward, and carrying a roller or rollers, which, as the carriage runs in, move upward and revolve against the roller beam, but when the carriage runs out, then the turning of the levers upon their centres conveys the said rollers clear of the roller beam. *Patent abandoned.*

2292. J. Hearne. *Improvements in apparatus or appliances to be used in the treatment of hospital and other patients.* Dated August 14, 1862.

This invention consists in the application of a framework which is mounted over the bed of the patient and furnished with a system or series of cords which are conducted over suitable pulleys carried by the framing; the ends of these arms are pendent over and distributed around the area occupied by the patient. The free ends of the cords are conducted and fastened to a double-armed lever mounted on the end standards, by which lever power can be applied to any number of the cords simultaneously to lift any weight attached to the opposite ends. The patentee disposes the pendent cords in pairs one at each side of the head, one at either shoulder or across the back, one at either side of the loins or thighs, and one at either side near the feet—in all eight, but this number may be varied. One or more pairs of these suspending cords may be arranged separate independently from the lever before mentioned, so as to permit a greater or less lift for the head and shoulders, or other parts of the body that may be necessary. Suitable pawls and ratchets or other means are provided for fixing the lever or hand bar in position when the patient is raised, to which bar a single pair of cords only may be attached. The pendent cords are provided with hooks or other means of easy attachment, to which bands or cradles, in which parts of the body are supported, may be applied. This system of support is also applicable for support of the bed-clothes of a patient or other articles that may be necessary to be supported independently of the bed. The upper horizontal framework is carried on standards raising it sufficiently above the bed for all purposes that may be required. This apparatus might also be supported from a bedstead having an overhead framework, but he preferred to make it complete in itself. *Patent completed.*

2293. W. Soulter. *Certain apparatus for raising and planishing metals.* Dated August 14, 1862.

We cannot here give space to the details of this invention. *Patent abandoned.*

2294. W. B. Herapath. *Improvements in decolourizing solutions of sugar.* Dated August 14, 1862.

For the purposes of this invention, the inventor adds to the solution or juice a small portion of the hydrochlorite, of an alkali, or of an alkaline earth, that which he prefers being the hyperchlorite of lime or ordinary bleaching powder; this he dissolves in water, and he adds the solution to the saccharine juice or solution of sugar. Afterwards he can separate the lime by the addition of phosphate of soda and potash, which converts it into an insoluble phosphate of lime, which is separated by filtration. *Patent abandoned.*

2295. J. S. Blockey. *Improvements in the manufacture of colouring matters.* Dated August 14, 1862.

For the purposes of this invention, the inventor adds to aniline or its homologues, a mixture of nitric and hydrochloric acid, and he maintains this compound for some time at a temperature of about 180 deg. Fah., and thus he obtains the colours required, viz., a mixture of red, purple, and blue, the proportions of which will vary according to the quantity of the acids employed. The colours contained in the mixture may be separated the one from the other and purified. *Patent abandoned.*

2296. W. B. Herapath. *Improvements in treating crystallizable sugar to render it more suitable for fermentation and conversion into alcohol and vinegar.* Dated August 14, 1862.

This invention consists in preparing cane, beet, or other crystalline sugar of like character, so that its fermentable properties shall be greatly increased, and the process of fermentation rendered more certain and constant thereby, and the inventor treats it in the following manner:—He dissolves the sugar in hot water, either previously or subsequently acidulated with tolerably pure hydrochloric acid (but more especially rendered free from all contamination with iron); and having raised the temperature of the mixture from about 180 deg. Fah. to 212 deg., and kept it at that temperature during two or three hours, more or less, he neutralizes the acid by adding to the mixture a sufficient quantity of carbonate of soda, carbonate of potassa, lime water, milk or cream of lime, carbonate of lime, or any other suitable substance; and if no excess of these neutralising agents has been improperly applied, the solution will be immediately in a fit state for undergoing the process of fermentation, without undergoing any further change than the simple reduction of the temperature and gravity to those points at which the process is usually begun in the brewing trade. But if the colour of the sugar employed has been dark or high-coloured, it might be necessary, for some purposes, to further submit it to a decolourizing or bleaching process, so as to render it sufficiently free from colour to be serviceable for the end in view. *Patent completed.*

2297. G. E. Spagnoletti. *Improvements in the manufacture of apparatus for signalling trains on railways.* Dated August 14, 1862.

For the purpose of signalling trains on railways from one point to another when a train passes, and when the line becomes clear, the patentee employs instruments each having a dial and two finger-keys. In connection with the dial is a magnetic needle, surrounded with coils of insulated wire, and having mounted on it two screens; on one of these are written the words "line clear," and on the other the words "train on the line;" and the screens are so arranged in connection with a hole in the dial-plate behind which they work, that when the needle inclines to one side, the notice on the screen on one side of the needle becomes visible, and similarly when the needle inclines to the other side, the notice on the other side is read. The screen with the notice "line clear" he colours white, and the screen with the notice "train on the line" he colours red, so that the signalman may readily see from a distance how the needle is standing. The finger-keys of the instrument are similarly coloured, and the parts are arranged so that depressing the red finger-key will make such contact as will cause a current of electricity to pass from the battery which works the instrument through the coils around the magnetic needle in such a direction as to cause the said needle so to incline as to show the words "train on the line" on the red screen. By depressing the white finger-key, a current of electricity will be similarly caused to traverse the coils, so as to cause the needle to incline in such a manner as to show the words "line clear" on the white screen. *Patent completed.*

2298. M. A. F. Mennons. *An improved apparatus for the production of sealing wax impressions.* (A communication.) Dated August 15, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2299. J. Barclay. *Improvements in machinery for the manufacture of nails.* Dated August 15, 1862.

This invention consists—1, In the mode of heading and pointing nails made from wire. 2, In the mode of cutting off short-pointed strips, the length of the nail from sheets of metal, and in the use of pressure rollers for consolidating the said short strips and making same into nails. To manufacture nails from wire, the patentee employs four levers—two working horizontally, and two vertically; the end of each pair of levers operate so as to squeeze the wire to a point, and are operated upon by slides and rollers. The heading operation is performed by a sliding heading tool; a revolving plate, fitted with spring sliding holders, takes the pieces of wire from the heading tool, and carries them successively opposite to the pointing tool. Expanding dies, operated upon by a screw for opening and closing the same, are employed to hold the wire whilst it is advanced and cut off to the desired length to form a nail. He also proposes to employ a circular piece of metal or table suitably held, and capable of being moved about its axis of motion, so that, supposing a strip of sheet metal of the width of the required length of the nails to be made therefrom to be placed on the table, and the table to be moved about its axis of motion by suitable self-acting mechanism, the said strip, instead of being presented square to the cutters, is inclined thereto sideways, and then cut; the strip is afterwards moved in an opposite direction, and again cut, the effect of which is to cut strips of a wedge form instead of with parallel sides, or, in other words, to cut the strips pointed. The heading operation is effected by a bent lever operated upon by a cam, each nail being held by expanding dies operated upon by sliding pieces of metal formed with inclined or wedge shaped ends. Each strip of metal cut off the main strip falls upon a vibrating piece of metal formed with two sides, which throws the cut pieces alternately down two channels formed in a casting, thence they pass between the pressure rollers before referred to, where they get consolidated, and finally are taken hold of by the expanding dies, and held thereby during the heading operation. The above machinery is designed to be double-acting, that is to say, whilst one nail is being headed on one side of the machine, the other side of the machine is discharging a finished nail. *Patent Completed.*

2300. A. Sheppard. *Improvements in obtaining light.* Dated August 15, 1862.

This invention has for its object improvements in obtaining light by combining oxygen gas or carbonic oxide at or near the point of combustion with vapour of naphtha or other hydro-carbon oil for the purpose of obtaining light. *Patent abandoved.*

2301. T. Carvin. *Improvements in screw propellers.* Dated August 15, 1862.

This invention consists of certain improvements in screw propellers, whereby the pitch of the blades may be more readily adjusted and fixed than by the methods at present in use, and by the application of which to vessels a greater speed can be obtained than by the ordinary propellers. The patentee forms the blades of the propellers of an irregular oval outline, the blades being bent or bowed so as to form a curvilinear surface to act upon the body of water in contact therewith, whereby the water may be gradually and easily displaced, and the vessel propelled without any sensible vibration being caused by the propeller. In some cases he prolongs or extends the extremities of the blades, so as to form their outline of an elongated irregular oval. *Patent completed.*

2302. T. F. Kirby. *Improvements in garments for gentlemen and ladies' wear.* Dated August 15, 1862.

This invention consists in certain improvements—1, in garments for gentlemens' wear, having for their object the combination of the vest and coat, in order to form one garment of the two; and, 2, in mantles, cloaks, capes, or jackets worn by ladies, the object of which is to attach an interior body fastening in the front, forming of the two one garment, on the same principle as in the first instance. *Patent completed.*

2303. J. Newman. *Improvements in machinery for the manufacture of metallic tubes.* Dated August 15, 1862.

This invention has for its object improvements in machinery for the manufacture of metallic tubes, whereby several tubes are capable of being drawn at the same time by one drawing head or bench, in place of drawing such tubes singly, as heretofore practised; the invention being particularly applicable to the drawing of solid metal tubes of comparatively small bore, suitable for being employed in the construction of locomotive and other steam boilers. For this purpose, in place of connecting each tube and mandril (where a mandril is used) to a separate draw chain or other draft instrument, the inventor causes a series of tubes with their mandrils (when such tubes are of comparatively small diameter) to be connected in any convenient manner to a draw bar or cross head, which moves to and fro on fixed guides. Motion is given to the draw bar or cross head by a chain or otherwise, in order to draw the tubes through the openings in the draw plates, which are fixed and arranged in a series to correspond with the tubes, such draw plates being of the ordinary construction. *Patent abandoned.*

2304. J. Carter and J. Maher *Improvements in power looms.* Dated August 15, 1862.

The object of this invention is to simplify the construction of the parts for working the shuttle boxes of power looms, and to bring them severally as required into line with the open shed. To this end, the patentees cause the levers from which the shuttle boxes are suspended to rock and raise the boxes by motion obtained from the main driving shaft, and they effect the tripping of these levers, so that they may fall and let down the boxes from a motion derived from the same main driving shaft. The shuttle boxes they lift by means of eccentrics or cranks on the driving shaft, which are connected by straps to a pair of catch rods, and by their rotation give an up and down motion to those rods. The catches of these rods are intended to take into pins projecting from the sides of the shuttle-box levers when the boxes are to be raised, and on their descent to rock the levers and elevate the boxes. When, however, it is desired that no such action shall take place, the eccentric catch rods are allowed to be brought forward by a spring, so that in their descent, actuated by the eccentrics, the hooks on their upper end, and on the right hand will pass by the pins of the box levers. By this means the hooks on the left hand side of these rods are brought over the disengaged ends of the pendent catches (which act as stops to the shuttle-box levers, and maintain the shuttle boxes in their different positions), and press the catches to a different position on the box lever, so as to allow the shuttle box required to come into line with the open shed. The reversing motion is obtained by the agency of two eight-sided star wheels, on a small cross shaft, supported in the top rails of the loom. These star wheels are different in size. On the top of a shaft (driven from the main shaft by toothed wheels equal in size) are two circular surfaces to correspond with the star wheels, and ,as the one or the other is in position, a back or forward motion is given to the chain box. *Patent completed.*

2305. J. H. **Johnson.** *Improvements in electro-magnetic time keepers.* (A communication.) Dated August 15, 1862.

This invention relates to a peculiar construction and arrangement of what the inventor terms a galvanic chronometer, with centrifugal regulator, and consists—1, of a peculiar construction and arrangement of electro-magnetic machine for actuating the works of the chronometer, and of which it forms a part; and, 2, of a peculiar construction and arrangement of centrifugal regulator for controlling the speed of the electro-magnetic machine, and thereby regulating the movements of the chronometer. *Patent completed.*

2306. R. **Barclay.** *Improvements in chronometers and other time keepers.* Dated August 16, 1862.

This invention comprises improvements in the escapement details of chronometers and other time keepers, and in the details by which the force of the spring is communicated to the wheelwork. The first portion of the improvements is applicable to the kind of chronometer escapement in which springs requiring extremely delicate adjustment have heretofore been used, and consists in causing the lever or vibrating bar acting as the detent or pallet of repose, instead of being actuated through a delicate spring, to be acted upon in one direction by a second rigid arm or lever, jointed or connected to it in such a way as to be free to move away from it in the other direction. The second portion of the improvements relates to an arrangement dispensing with the chain by which the force of the spring is ordinarily communicated to the fusee. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Oct. 23, 1862.

2851. J. T. Stroud, Birmingham, lamp and chandelier manufacturer. Improvements in lamps for general and special purposes, and in parts connected with the same.

Dated Nov. 11, 1862.

3039. H. Burridge, 15, Grenville-street, Brunswick-square, builder. Improvements in apparatus for extinguishing fires; applicable also for ventilating and fumigating, and for supplying, delivering, and distributing fluids.

Dated Dec. 29, 1862.

3489. W. Billinghurst and J. Requa, Rochester, New York. An improved portable battery.

Dated Jan. 6, 1863.

49. J. Eckersley, Westhoughton, Lancaster, mechanic. Improvements in looms for weaving.

Dated Jan. 9, 1863.

83. W. Tasker, Waterloo Iron Works, near Andover, engineer. Improvements in the construction of harrows.

Dated Jan. 19, 1863.

165. B. V. der Mark, 8, Great John-street. Manchester. A new and improved musical instrument of the harmonica class.

Dated Jan. 26, 1863.

230. A. L. Liétout, Paris, doctor of medicine, and J. B. Roisin, 56, Rue de Sablonville. Improvements in gymnastical apparatus.

Dated Jan. 31, 1863.

285. J. Lightfoot, Accrington, chemist, and F. Trachsel, Manchester, chemist. Improvements in machinery or apparatus used in the process of distillation.

Dated Feb. 4, 1863.

320. C. F. and D. Faulkner, Birmingham, gun-barrel manufacturers, J. Fairley, Birmingham, commercial agent, and W. C. Stiff, Edgbaston, military gun inspector. Improvements in the manufacture of gun barrels.

Dated Feb. 7, 1863.

347. C. Parigot and A. Grivel, 29, Boulevart St. Martin, Paris, civil engineers. Improvements in locks.

Dated Feb. 12, 1863.

379. F. Oppenheim, 379, Strand. An improved plastic compound for dental purposes, to be used instead of wax, gutta percha, or resinous gums, in taking the impression of the mouth. (Partly a communication.)

Dated Feb. 13, 1863.

388. J. Jones, Liverpool, lead merchant. Improvements in the manufacture of lead, tin, and other metals, or amalgamation of metals of a like fusible nature, into sheets of any required thickness and length, and also coating one or both sides of pipes and sheets of lead, and other metal, or amalgation of metals, with tin or other substances, and in the apparatus connected therewith.

390. J. Robertson, foreman printer, Levenbank Print-works, Dumbarton. Improvements in apparatus or means for printing woven fabrics by blocks.

392. W. Robertson, Manchester, mechanical engineer. Improvements in machines for spinning and doubling.

393. G. Wrigley, Dukinfield, machine maker, and S. Morris, mechanic. Improvements in machines for spinning and doubling.

394. O. H. Hodge, Shoreditch, hat maker. Improvements in hat brims, in the manufacture of hat brims, and in the apparatus or machinery used in such manufacture.

396. S. Whitaker, Craddock-street, Haverstock-hill, electrician. Improvements in indicating the positions or conditions of railway signals and points, and in the apparatus employed therein.

Dated Feb. 14, 1863.

398. R. Baguley, Greenlow Mill, Blackburn, shuttle manufacturer. Improvements in the construction of creels for warping machines, and other machines to which creels are applied.

400. W. C. Paul and A. T. Shore, Queen's-road, Bayswater, upholsterers. Improvements in the mode of constructing spring mattresses and other such articles for sitting and reclining upon.

401. J. S. Gisborne, Birkenhead, electrical engineer, and W. Simpson, Liverpool, gentleman. Improvements in means for rendering ships' and other compasses insensible to local attraction.

402. H. Dembinski, 13, Rue de l'Oratoire du Roule, Paris, general. A new motive apparatus and processes proper for giving to it a continuous motion and unlimited strength.

404. W. Wood, Ashton-under-Lyne, manager. Certain improvements in cutting or producing screws or threads, and in apparatus connected therewith.

406. J. H. Walsh, Kensington. Improvements in breech-loading firearms, and in the cartridge cases to be used therewith.

408. W. Clark, 53, Chancery-lane, engineer. Improvements in the method of, and apparatus for, separating the fibres of straw, wood, and other vegetable substances, and extracting the gummy and colouring matters therefrom, to render them fit for paper stock, or for other purposes. (A communication.

410. J. and H. Higgins, Salford, machine makers. Improvements in carding engines, and in apparatus connected therewith.

412. J. Morgan, 23, Stephen's-green North, Dublin, Esq., F.R.C.S.I. Improvements in embalming and preserving from decay human bodies and bodies of other animals; also pickling, curing, and flavouring animal bodies.

Dated Feb. 16, 1863.

416. C. D. Abel, 20, Southampton-buildings, Chancery-lane. An improved omnibus. (A communication.)

418. J. B. Watts, Birmingham, sword and bayonet manufacturer. Improvements in the manufacture of matchets and swords.

420. R. A. Brooman, 166, Fleet-street. An improved cover or protection for steel and other metal springs, ribbands, and hoops. (A communication.)

422. J. H. Haywood and W. Vernon, Nottingham, lace manufacturers. Improvements in packing bonnet fronts, rouches, and other similar articles.

424. W. Nalder, Challow Works, Wantage, Berks, engineer and agricultural implement manufacturer. Improvements in rotary screens, and in the machinery or apparatus employed in the manufacture of such screens.

Dated Feb. 17, 1863.

426. T. W. Salmon, Mile-end Old Town, mechanic. Improvements in washing machines.

428. W. T. Dibb, Hull, brewer. An improvement in brewing.

430. J. Gimson, Leicester, mechanical engineer. Improvements in presses for punching or cutting out leather and other substances.

432. J. Durant, Sussex-street, St. Pancras, engineer. Improvements in chimney tops.

434. J. W. Lane, Caledonian-road, watchmaker. Improvements in fastenings for studs, sleeve fasteners, solitaires, bracelets, brooches, and other uses.

436. H. Tomlinson, Rotherham, stove grate manufacturer. Improvements in stoves or fireplaces for warming apartments.

Dated Feb. 18, 1863.

438. E. Strawson, 9, Royal Arcade, New Oxford-street. Improvements in the manufacture of buttons, which may be instantaneously attached without sewing.

439. G. K. Geyelin, civil engineer, 13, Chenies-street, W.C. An improved grate, whereby the perfect combustion of the various compounds of coal is produced.

440. M. Siégrist, Ewell, gentleman. An improved atmospheric brake or break.

442. J. F. Spencer, Newcastle-upon-Tyne, consulting engineer. Improvements in apparatus for regulating and working the valves of steam and other engines.

444. F. Johnston, manufacturer, and R. Heatley, overlooker, Blackburn. Certain improvemehts in looms for weaving.

446. G. T. Bousfield, Loughborough-park, Brixton. Improvements in breech-loading firearms. (A communication.)

Dated Feb. 19, 1863.

452. T. Markland, Hyde, and J. C. Dickinson, Blackburn, machine maker. Certain improvements in machinery or apparatus for warping or beaming yarns or threads.

454. L. A. Pouget, 39, Rue St. Sébastien, Paris, lamp manufacturer. Improvements in the manufacture of oil lamps.

456. J. J. Badart, 56, Bishopsgate-street. Improvements in the preparation of cotton seed cake.

458. N. Thompson, 15, Abbey-gardens, St. John's-wood. Improvements in apparatus for stopping bottles, jars, and other vessels, and in tools for producing parts of such apparatus.

Dated Feb. 20, 1863.

462. C. Billingsley, Manchester, saddler, Improvements in saddlery, harness, driving straps, and similar articles.

464. C. W. Siemens, 3, Great George-street, Westminster. Improvements in insulating and supporting telegraph line wires.

470. W. Husband, Hayle, and J. Quick, Sumner-street, Southwark, civil engineer. Improvements in apparatus for raising sewage and water.

Dated Feb. 21, 1863.

472. R. Thompson, Haigh Foundry, Wigan, engineer. Improvements in apparatus for moulding.

474. F. J. Manceaux, Paris, gun manufacturer. Improvements in firearms, or of transforming arms of large calibre into arms of smaller calibre.

476. R. V. Dodwell, Manchester, district engineer to the Magnetic Telegraph Company. An improved method of preventing the destruction of plants by insects and certain descriptions of animals, and in the means for effecting the same.

478. A. Crileur, Shawbury Villas, Camden-road, photo-lithographer. Improvements in apparatus for taking photographic impressions or likenesses by means of the camera.

480. H. Mackinder, Mere Hall, Lincoln. Improvements in apparatus for separating potatoes into different sizes.

482. A. Dugdale, Rue de Courcelles, Paris. Improvements in throttle valves.

Dated Feb. 23, 1863.

486. E. T. Hughes, 123, Chancery-lane. Improvements in the process of cleaning organic matter. (A communication.)

488. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in dressing millstones, in ornamenting or engraving on glass, pottery, and other similar substances, and in materials employed therein. (A communication.)

490. J. D. and A. P. Welch, Gutter-lane, straw hat manufacturers. Improvements in machinery for blocking and pressing hats and bonnets.

492. T. R. Harding, Leeds, hackle pin manufacturer. Improvements in carding and combing flax, wool, cotton, and other fibrous substances.

494. J. Tatham, Rochdale, machine maker. Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.

Dated Feb. 24, 1863.

500. J. Hawthorn, Burslem, china manufacturer. Certain improvements in handles for doors, drawers, and other means of enclosure.

504. J. Le-Butt, Bury St. Edmunds. Improvements in machinery for dressing grain.

506. D. B. Chatterton, Chester, mechanical engineer. Improved brick-making machinery.

508. H. B. Willson, Montague-place, Russell-square, barrister-at-law. Improvements in the construction of war and merchant ships.

510. A. Jünger, Hamburg, tailor. An improved life-preserving garment.

512. R. W. Thompson, Edinburgh, civil engineer. Improvements in obtaining and applying motive power; which improvements, or parts thereof, are applicable for raising, forcing, and measuring fluids.

514. W. Clark, 53, Chancery-lane, engineer. Improvements in sewing machines. (A communication.)

Dated Feb. 25, 1863.

516. H. Wilde, Manchester, engineer. Improvements in electro-magnetic telegraphs.

520. J. Fitter, Birmingham, machinist. An improvement or improvements in the construction of castors for tables, chairs, and other furniture or other articles.

522. E. B. Wilson, 5, Parliament-street, Westminster, civil engineer. An improvement or improvements in the manufacture of an alloy, or alloys, of titanium and iron.

524. B. Lawrence, Newport, Monmouth, architect, and W. Niblett, engineer. Improvements in apparatus for regulating the flow of gas for purposes of illumination.

530. W. Hudson, Burnley, gentleman, and C. Catlow, overlooker. Improvements in looms for weaving.

534. G. Tomkins, Morriston, Glamorgan, tin plate

worker. Improvements in the manufacture of tin and terne plates, and in the apparatus to be employed therein.

Dated Feb. 26, 1863.

536. W. H. Brown, Walham-green, gentleman. Improvements in window frames and in glazing windows.

538. G. H. Lilley, Dalston, draughtsman. Improvements in apparatus for connecting and securing together planks of wood applicable to the building and caulking of ships and other vessels.

542. J. Yates, Rotherham, iron master. Improvements in the manufacture of armour plates, or blocks, for defensive purposes.

544. W. Clark, 53, Chancery-lane, engineer. Improvements in the manufacture of buttons, and in apparatus for the same. (A communication.)

546. J. Humby, 14, Gresham House. Improvements in furnaces and apparatus for manufacturing oxide of zinc or zinc white. (A communication.)

548. F. H. Twilley, Dean-street, Soho. Improvements in book slides or holders.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, March. 10, 1863.

2851. J. T. Stroud. Lamps.

2889. T. Pilgrim. Locks, bolts, latches, and other fastenings.

2893. G. Lindemann. Manufacture of bricks, tiles, slabs, and other articles of earthenware.

2896. J. Howie. Regulating the supply of solid or liquid bodies to mills or other apparatus used in mixing or preparing plastic matters.

2912. W. Clark. Ascertaining and recording the speed and distance travelled by vehicles, the flow and quantity of water, and other analgous purposes. (A communication.)

2916. W. E. Evans. Apparatus for playing organs, harmoniums, pianos, and other similar keyed instruments.

2918. W. E. Gedge. Looms. (A communication.)

2926. H. Eastwood. Boilers and furnaces.

2927. F. Gregory. Presses for pressing seeds, fruits, hops, and other substances.

2939. G. Dickinson and E. Cooke. Construction and ornamentation of metallic bedsteads.

2955. J. W. Taylor. Scouring or cleansing woollen, worsted, and cotton fabrics.

2958. E. Stevens. Iron shelves, stands, and racks.

2962. F. Tussaud. Cutting metal.

2663. J. Musgrave. Valves of steam hammers.

2968. E. Humphrys. Centrifugal pumps.

2969. W. Clark. Castors. (A communication.)

2970. T. O. Clark. Portable spring-bottom bedstead. (A communication.)

2973. R. A. Brooman. Machinery for moulding and compressing artificial fuel. (A communication.)

2974. W. H. Stallard. Umbrellas and parasols.

2976. J. Lefebvre. Indicating angles or variations of level.

2977. F. Durand. Cotton gin.

2982. P. W. Reuter. Dyeing. (A communication.)

2984. R. A. Brooman. Manufacture of fringes. (A communication.)

2985. J. Shirt and C. Briggs. Condensing the steam of high pressure steam-engines.

2988. A. Wall. Purifying lead, and extracting and separating silver therefrom.

2993. R. A. Brooman. Commodes or water-closets. (A communication.)

2994. R. A. Brooman. Taps or cocks. (A communication.)

2995. R. A. Brooman. Spinning frames. (A communication.)

2996. C. Shield. Manufacture of malleable cast-iron.

2998. J. Petrie and J. Teal. Washing fibrous materials.

3006. H. Griffin. Securing india-rubber cylinders or rollers and blocks upon spindles and other bodies on which they are to be mounted.

3008. J. A. Fullarton. Painting or coating iron.

3016. H. Kilshaw and E. Lord. Power looms.

3021. E. Sonstadt. Manufacture of the metal magnesium.

3022. G. Kent and E. P. Griffiths. Reducing cocoa berries and other vegetable and animal substances to powder or pulp, and for mashing potatoes.

3027. J. B. Lavoine. Kitchen range.

3028. S. Berrisford and W. Ainsworth. Looms.

3032. W. E. Newton. Treatment of maize or Indian corn. (A communication.)

3034. T. G. Ghislin. Treatment of certain foreign plants.

3048. F. J. Clowes. Obtaining rotary motion.

2055. G. W. Rendel. Strengthening armour plates, iron or steel.

3067. E. B. Wilson. Conveying air, steam, gases, and fluids.

3090. C. Littleboy. Cultivating land.

3146. A. V. Newton. Machinery for cutting corks. (A communication.)

3150. W. Clark. Obtaining a vacuum or partial vacuum as applied in the manufacture of paper. (A communication.)

3251. R. D. Kay. Manufacture or finishing of endless machine blankets.

3358. J. J. Lemon. Book trays.

3416. E. R. Dann. Goffering apparatus.

113. J. B. Rock. Apparatus for saving life and property from fire.

173. W. Clark. Looms for weaving textile fabrics. (A communication.)

232. H. H. Henson. Fabrics for covering floors, walls, roofs, and other surfaces or objects.

257. J. H. Johnson. Manufacture of braid. (A communication.)

291. E. B. Wilson. Supplying air, gases, steam, or fluids to iron and other furnaces.

395. J. A. Schlumberger. Treating coal tar dead oils, and for producing phenic or carbolic acid. (A communication.)

447. F. J. Reed. Apparatus for traversing guns. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed Feb. 24, 1863.

30. W. E. Newton.
2480. F. Selby.
2484. J. Saunders.
2485. J. Saunders.
2495. W. A. Munn.
2497. G. Weeks.
2500. J. Hemsley.
2501. R. A. Brooman.
2503. L. C. Hoyau.
2514. J. R. Johnson and J. S. Atkinson.
2518. A. J. Moreau.
2519. H. Higgins.
2520. G. Bedson.
2525. T. W. Cowan.
3562. J. W. Woodford.
2634. M. Henry.
2720. M. A. F. Mennons.
3336. J. W. Baker.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

808. A. Pentzlin.
600. J. H. Johnson.
699. W. Weild.
602. T. W. Ashby and J. Coulson.
644. W. E. Newton.
880. W. Clark.
617. R. Pitt.
625. J. Imray and J. Copeland.
636. G. Spiller.
640. C. Sheldon.
650. J. H. Young.
776. J. M. Carter.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

609. G. Rees.
893. A. V. Newton.
626. R. W. Winfield, J. Simms, and T. Lloyd.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending March 7, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2127	1 2	2139	0 10	2150	0 6	2061	0 8	2172	0 8	2183	0 10
2128	3 0	2140	0 6	2151	0 8	206[illegible]	0 8	2173	0 4	2184	0 4
2129	0 4	2141	0 8	2152	0 4	2163	0 8	2174	0 4	2185	0 10
2130	0 4	2142	0 4	2153	0 4	2164	0 4	2175	0 10	2186	0 10
2131	0 4	2143	0 4	2154	0 4	2165	0 6	2176	0 4	2187	0 4
2132	0 4	2144	0 8	2155	0 8	2166	0 4	2177	0 4	2188	1 10
2133	0 10	2145	2 6	2156	0 6	2167	0 10	2178	0 4	2189	0 4
2134	0 4	2146	0 4	2157	0 6	2168	0 10	2179	0 4	2190	0 10
2135	1 10	2147	0 10	2158	1 0	2169	1 0	2180	0 6	2191	0 4
2136	0 4	2148	0 4	2159	0 4	2170	0 10	2181	0 8	2192	0 4
2137	0 4	2149	0 4	2160	1 8	2171	3 0	2182	0 6	2193	0 6
2138	0 4										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback, 1s.

		£	s.	£	s.
Teak	load	14	0	15	0
Quebec, red pine		3	10	4	10
,, yellow pine		3	0	4	0
St. John, N.B., yellow		5	0	5	10
Quebec oak, white		5	10	6	10
,, birch		3	0	3	10
,, elm		3	10	5	0
Dantzic, oak		3	10	6	10
,, fir		2	10	3	10
Memel, fir		3	0	3	5
Riga		3	0	3	5
Swedish		2	10	2	15
Masts, Quebec red pine		5	0	6	0
,, yellow pine		5	0	6	0
Lathwood, Dantzig, fm.		5	10	6	10
,, St. Petersburg		8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					
Quebec, white spruce		15	10	19	10
St. John, white spruce		14	10	16	10
Yellow pine, per reduced C.					
Canada, 1st quality		17	0	18	0
,, 2nd do		11	0	12	0
Archangel, yellow		13	0	13	10
St. Petersburg, yellow		11	10	12	0
Finlan		9	0	10	0
Memel		10	0	15	0
Gothenburg, yellow		10	0	11	0
,, white		9	0	9	10
Gefle, yellow		10	0	11	10
Soderhamn		9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.					
,, yellow		21	0	22	0
Deck Plank, Dantzic, per 40 ft. 3 in.		0	14	1	4
PUMICE STONE. per ton		5	10	9	0

OILS, &c.

		£	s.	£	s.
Seal, pale	per tun	48	0	0	0
Sperm body		84	0	86	0
Cod		47	10	49	0
Whale, South Sea, pale		43	10	44	0
Olive, Gallipoli		59	0	0	0
Cocoanut, Cochin		52	10	53	0
Palm, fine		38	0	36	10
Linseed		43	0	0	0
Rapeseed, English pale		53	0	53	10
Cottonseed		34	0	44	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
IRON:									
Welsh Bars, in London	per ton	6	10	0	to	6	15	0	2½
Nail Rods	,,	7	5	0	,,	7	10	0	,,
Hoops	,,	8	10	0	,,	8	15	0	,,
Sheets, single	,,	9	10	0	,,	9	15	0	,,
Staffordshire Bars	,,	7	10	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	17	6	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	14	0	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
STEEL:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	0	0	,,	18	0	0	,,
COPPER:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8½	,,	0	0	8½	,,
Fine Foreign	per ton	95	0	0	,,	96	0	0	3
TIN:									
English Block	pr cwt.	5	19	0	,,	0	0	0	2½
Bar	,,	6	0	0	,,	0	0	0	,,
Refined	,,	6	4	0	,,	0	0	0	,,
Banca	,,	6	2	6	,,	6	3	0	nett
Straits	,,	6	1	0	,,	6	2	0	,,
TIN PLATES:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	2	6	,,	1	4	0	,,
LEAD:									
Pig, English	per ton	21	0	0	,,	21	10	0	2½
Spanish, Soft	,,	20	7	6	,,	20	10	0	,,
Shot, Patent	,,	23	15	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	0	0	0	,,
SPELTER:									
On the spot	,,	18	2	6	,,	18	5	0	nett
ZINC:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
QUICKSILVER	pr btl.	7	0	0	,,	0	0	0	3
REGULUS OF ANTIMONY:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,

4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MARCH 20, 1863.

IRON SHIPBUILDING BY CONTRACT.

In the drawn battle between the Controller of the Navy and the iron shipbuilders, there is in all probability truth on both sides, and the public are more likely to hear all that can be said against the Admiralty manifesto, than to be made aware of the complete state of the case against the contractors.

But, were we disposed to admit unreservedly the statements of Admiral Robinson with regard to the shortcomings of the private shipbuilders, we should be unable to justify the public attack upon them. The Admiralty has, or should have, the remedy in their own hands for any negligence or breaches of contract; and it is not satisfactory to know, that while they publish such grave charges against the contractors, their power of enforcing penalties has never once been exercised. Instead of punishing offenders, they have made large grants in favour of those who had distinguished themselves in a marked manner, by fulfilling their legal engagements.

It appears to us that the Admiralty system of granting contracts has very much to do with the failure of the builders to fulfil their engagements, and that it is fairly chargeable with part of the discredit.

A moment's reflection must have shown, even before they had the benefit of experience, that in such a matter as building an entirely novel description of ship, the construction of which would extend over two or three years, it would certainly become necessary to make alterations and additions which would invalidate any ordinary contract. Such alterations and additions have been made in every ship built for the Government. They were absolutely necessary; and to have allowed themselves to be deprived of such an advantage because of the breach of contract involved, would have been most unwise on the part of the Admiralty.

With this certainty before them, where was the use of a contract? It might have been so drawn up as to compel the builders to alter anything, and add everything which the Admiralty might think proper to order during the progress of the work, without any additional charge. We believe, in fact, that some of the contracts contained provisions amounting almost to this. But the contractors knew perfectly well that such absurd provisions would never be enforced; and they eagerly accepted the terms, regarding these extraordinary clauses as triumphs of official sagacity, which pleased the authors, and would not in any way hurt them. They knew that scores of breaches of contract, involving awful penalties, had been made during the Russian war, none of which had ever been enforced; and they knew, moreover, that according to official notions, the citation of a precedent was as good as an Order in Council. They therefore sent in low estimates, and excited the interest of their friends, for the purpose of securing the order to build on the Admiralty terms.

In the strength of their virtuous resolve to be uninfluenced by any party or personal considerations, their Lordships would be tempted to accept the lowest tender, although the firm tendering might be, by reason of insufficient capital and poverty of mechanical resources, most unfit to assume such responsibility, and conduct such vast operations. The consequence would be, as might have been anticipated, that many weeks and months would be consumed before the ground, plant, and materials were ready for the commencement of an undertaking, which although called by the same name, would be very unlike their ordinary operations.

No one inspecting the nature of the structures now growing into completeness in the dockyards on the Thames, from the Admiralty designs and under their supervision, can fail to perceive how different it is from ordinary iron boat building, both in the principle and in the manner of execution. "This is not," we are told by the foremen, "ship-building; it is engineering." The issue of the matter is, that, after vexatious delays from the want of preparation on the part of the contractors, of still further delays from the rejection of inferior material and workmanship on the part of the inspectors, the ship is complete. But the ship is known to have cost many thousands of pounds more than is due under the contract. Enforcement of penalties is out of the question; and it only remains to be settled how much shall be allowed for extras, and towards the reimbursement of the contractor. In such a case it is clear, that it would have been far better to have given the order to build the ship to some well-established and trustworthy firm, and to have arranged for payment upon some equitable principle, without imposing the fetters of a contract upon either party.

Although much may be said in favour of employing wood just now in the construction of iron-cased ships, the day is rapidly approaching when ships of all descriptions will be constructed of iron; but before that can come about, several difficulties will have to be removed. That they exist, no one can deny; that they are capable of removal, we cannot doubt. Under those circumstances, it will probably be desirable to build most, if not all, our ships of war in private establishments, and it will be necessary to consider whether such a course as that which we have indicated would not be more desirable than the continuance of the present system of contracts.

Some of the private builders are very indignant at the charge made against them in this document, that their work is often performed in a slovenly manner. They wish us to believe that, whatever amount of slovenly workmanship, and bad material, found their way into the wooden vessels built under contract for the Government, nothing of the kind is tolerated in the iron establishments. Having our suspicions on this matter, we turned to the recent volume of the "Transactions of the Institution of Naval Architects," which we have had under review during the last two or three weeks, and we find evidence, from an impartial witness, bearing directly on the point. In a Paper read by Mr. Grantham, the author of a very valuable work on Iron Shipbuilding, we are told that in a former Paper he had attempted to show that, "as regards *the distribution of the materials* in iron shipbuilding, the proportions which generally obtain are anything but satisfactory.

"As regards the *quality of the materials* used, I think it is generally agreed that it ranges from a strength represented by about 15 up to 35; 15 being a denomination for common boat plates, and 35 the improved iron called puddled steel, of which many vessels have been built. If it were possible to test the range over which the extremes of *bad and good workmanship* in the matter of jointing and rivetting extend, it is probable we should find it to be equal to either of the two former questions. I cannot, however, offer any direct proofs of the extent of this range. I can only assert that it is very wide; and I trust, in the course of my remarks, to throw out some suggestions that will tend not only to reduce it, but to ensure for those who take proper means to protect themselves, more reliable methods for obtaining sound vessels.

"The present system of jointing and rivetting iron ships may be compared to the mode of jointing machinery as it existed upwards of twenty years ago. No attempt was then made to fit the joints, but space was left for cement to be caulked into them: the bolt holes were also cast in the flanges, and made fair by chipping. This system in all good work is exploded: the joints are planed and no cement is needed: the holes for the bolts are drilled, and are an exact fit: the work is tight: the strength is much increased: and the weight of iron in the flanges reduced in proportion.

"In iron shipbuilding the ordinary system is to fit the joints by rude means, bringing them as close as is thought necessary, and by the caulking tool to do the rest, which in many cases amounts to nothing more than the concealment of defects. The holes also are punched as nearly opposite each other as is considered necessary and practicable, and a drift is supposed to set all right."

As regards butt joints, he goes on to say, it is notorious that in no place do iron ships sooner show weakness than in these, and in no part of iron shipbuilding is the system so deficient.

The method adopted in plating is, he tells us, to attach the plates to the frames of the ship in regular shear lines, commencing from the keel, if the vessel has one, and sometimes simultaneously at the shear strake, applying first those strakes that lie close, without lining pieces, to the frames. These plates being previously punched are brought together at the butts, and temporarily secured by bolts and nuts. To make the ends a tolerable fit, a hammer is generally used, knocking down the higher parts and throwing up a burr on one edge; but as this operation is very imperfect, the plates in reality only touch at points, and even in what appears to the eye a good joint, the plates often only touch at two or three points, perhaps for a quarter of an inch, or some very short length. In other cases, where still less care is observed, the joints will touch at one corner of the plates only, and be entirely separated from all the rest. These defects are quite visible at first, but when the butt plate is put on the light can no longer be seen through the joints, and thus observation is partially prevented. When the men are told of it, the reply is that the rivetting will stretch the plates and close the joint; but though this cannot be relied upon to any extent to compensate for the width too frequently left, yet all questions are set at rest by the caulking tool—a flat chisel which is passed over the joint—knocking down the burr which has before been raised, and closing the plates at the upper part of the joint. This system makes the joint *water-tight*, but is so evidently defective in strength that no one ought to be satisfied with it. All parts not really in contact, however slight the separation may appear, are deprived of the great additional strength which well butted plates must afford.

And, with regard to rivetting, he tell us that, as a rule, the holes in the plates through which the rivets are to go are never fair with each other. Under these circumstances, he says, "if the rivet be very hot, and the hole not very irregular, by dint of hard blows the hole is well filled and the work sound, though about this there is no certainty. But suppose the hole is very much distorted, the countersink half destroyed, and an abrupt angle at the centre caused by one plate partly overlapping the hole of the other, the effect" then is, that the holes "are not filled, and the rivet, when severely tested, becomes loose. There are, of course, all degrees of distortion; some so great that the head of the rivet will scarcely conceal the vacancy." "It is evident that wherever this vacancy occurs, however small it may be, the efficiency of the rivet is greatly reduced; and, supposing further (a case which occurs every day in our best ships), that in the same seam both the rivets and joints have the defects above described, how greatly must the general strength of the ship be diminished!"

In the face of such evidence as this, the virtuous indignation of our iron shipbuilders is rather out of place, and we must leave them with the hope that, before we are compelled to trust our fleets to their tender mercies, they will have been able to remove the causes of complaint on which the Controller of the Navy bases his case against them.

THE FIVE NEW IRON-CLADS.

THE division on Mr. Lindsay's motion, and the arguments which influenced the majority, disclose a melancholy picture of the corruption which pervades the administration of public affairs in this aristocratically governed country. A plain question of fact, affecting the most vital branch of national defence, and involving the expenditure of a million, is distorted and literally strangled by a combination of Ministerial misrepresentation and political juggling, which never have been surpassed. The Navy Estimates comprise a sum for the construction of five iron-clad men-of-war. The Government proves, to the satisfaction of the House of Commons, that this increase to our line-of-battle is imperatively called for All parties are agreed on that point. Liberals and Conservatives, patriots and economists, even the peace party, admit the necessity of the vote.

There is, however, a subsidiary question, on the vast importance of which all parties are equally unanimous, for upon it depends the honour and safety of the nation. Shall these five iron-clads be iron or wooden vessels? "From some defects in ships of war," says Lord Palmerston, "a battle may be lost, and no man can tell the disastrous results to a country of the loss of a naval engagement." This appeal to the good sense and patriotism of the House elicits cheers, and it is founded on truth; but, as we will presently show, the words are mere clap-trap in the mouth of the Premier. They are uttered to persuade members to support a measure, which, at the supreme moment, will immensely diminish the chance of victory to a British fleet.

The universal opinion of the House is in favour of iron ships. Admiral Robinson, in his statement, which may be taken as embodying the conclusions of the Board of Admiralty, says that an iron ship can be built of larger dimensions, has more rigidity and strength of structure as a whole, and has much greater durability than a wooden ship. Some imperfections in iron ships, especially local weakness of the bottom, and liability to foul, are mentioned; but these points are fully and fairly discussed by members without distinction of party, and the general assent is given to the conclusion that, after all, the defects referred to are of secondary importance. For the reason assigned in Admiral Robinson's statement, they are outweighed by the immense superiority of iron as the material for ships of war. But what means this discussion at the present day? What consummate hypocrisy it is on the part of Government, to question the superiority of iron over wooden armour-plated ships, when for the last twelve months they have never ceased describing the admirable qualities of the "Warrior," holding her up as the finest iron-clad in the world, because *she is built of iron*, whilst they insisted on the inferiority of the "La Gloire" and other French iron-clads, because *they are built of wood*.

Are the English people to be stultified in this way? Is a vote on a great national question to be carried in favour of Ministers and against common sense, because the "jaunty Premier," regardless of consistency, gives utterance to a patriotic sentiment, founded on misrepresentation. Those members of the deluded majority, whose votes were thus juggled out of them, must wince and feel ashamed, when they reflect that they are answerable for authorizing the Admiralty to build five ships-of-war of a material, deficient in strength and rigidity, which they know is the source of the defects by which a battle may be lost.

As Lord Palmerston has rightly placed the issue, in this grave question, on a possible naval defeat if we build defective iron-clads, let there be no tergiversation on that point. Is the "Warrior" as a war frigate superior in strength, speed, and sea-going properties, to the "La Gloire," and other French iron-clads; and is that superiority due to the former being an iron and the latter a wooden ship? If these be facts, why is the country to be tricked into the expenditure of a million, to add to its navy five men-of-war of the inferior and defective class, instead of five of the superior and effective class? If they be not facts, then has the country been shamefully imposed upon, by the reports ostentatiously published of the wonderful perfection of the "Warriors," "Minotaurs," and "Achilles," for which three or four millions were freely voted on the faith of those reports.

Whether the facts on one side or the other be true or not, there is but one inference to explain the course now taken by Ministers. The false position in which they place themselves by assuming the resposibility of building five men-of-war, arises from the jobbery which is the vice of Admiralty administration.

Wood is the life of the dockyards. The officials, from the Controller, through all the grades of the constructive department, to the shipwrights, masters and men, the favoured clique of contractors for timber, and their hangers-on—every individual of this large body has an interest in wooden, and none in iron, vessels, because the former can, and the latter cannot be built in the dockyards. The united influence of all their interest weighs so heavily on the Government, that Ministers are compelled to come down to the House and make out a case for wood against iron. The attempt is a bold one. It required all the cool effrontery and parliamentary skill of the Premier to undertake it. So far the plot promises success; but will it be carried through? Notwithstanding the large majority, perhaps not!

We will analyze the means by which votes have been caught, and by opening the eyes of honest members of the the majority to the deception practised upon them, we may succeed in turning their votes to the side of reason, truth, and patriotism, when the question again comes before the House.

Fortunately, there is a hope of salvation. To induce the House to leave to Ministers the responsibility of building five ships of wood or iron at their discretion, and not to tie the hands of the executive, Lord Palmerston was obliged to commit his Government to the promise, that the Admiralty will make experiments to ascertain which class of vessels "may be best suited to the wants of the country."

This is a specific pledge, to which the House of Commons, when it has recovered its senses, will keep the Premier fast bound. He cannot escape from it. He has already announced one course the Admiralty intends to follow. "In the course of this summer, there will be a mode of testing by experiment the qualities of the 'Royal Oak,' a ship of wood, but strengthened with an iron coating, as compared with those of the 'Hector,' a ship of the same size but built entirely of iron, and the result of that experiment, will instruct the Admiralty as to the course to be pursued with respect to the number of ships necessary to be built." So far, so good; but let it be the business of those independent members who understand this question, and have so ably defended the cause of iron, to keep their eyes upon the 'Royal Oak' and exact from Government the execution of the bond before any of the money voted for the five iron-clads be invested in wooden frames. If they do not, they may be assured that the manœuvre exposed by Mr. Cobden will be repeated. As the dockyard people, without the knowledge, it was stated, of the Board, first laid in an immense stock of wood, and then made that stock an argument for building wooden ships, so will the same official worshippers of wood, if not looked after, speedily convert timber into frames, and then will innocently urge that, on the score of economy, these frames must be converted into iron-clads, otherwise the money they have cost will be lost to the country.

But to fulfil the Premier's pledge, there remains another course, more important to the country than that determined upon by the Admiralty. A trial cruise of the "Royal Oak" in search of gales of wind may test her sea-going properties, and show how she carries her heavy weight of armour and armament; but the severest trials at sea will tell us nothing about her powers of resistance as an "iron-clad." They will not enlighten us as to whether her armour plates and teak backing on a wooden hull may not be more easily penetrated than the same armour on an iron hull. But "that is the question," and a question which must be solved positively and unequivocally before Parliament allows another shilling to be spent on wooden hulls or frames. Let Lord Palmerston's prophetic words be remembered! Defects in the construction of a man-of-war may lose a battle and imperil the safety of the country. What greater defect can there be than inferiority of resistance to the enemy's guns?

There is an easy mode of setting this question at rest—one so inexpensive that, after the debate last week, after the pledge extorted from the Minister, the House will not be true to itself or to the country if it do not exact the adoption of the mode we allude to which is to have a "Royal Oak" target constructed and fired at at Shoeburyness. If this be done, the country will know the value of an armour-plated wooden broadside. If it be not done, the country will have reason to be dissatisfied. To this extent Parliament may, without compromising itself, take the responsibility of dictating to the executive. This target should be of the same dimensions as the "Warrior" section, which we heard so much about. The expense will be about £2,000. If the House demand the expenditure of so small a sum for so good a purpose, they cannot be warned that it is unconstitutional to increase the expenditure beyond the Estimates. A handsome sum is set down for Admiralty experiments. Before that item is voted, let it be an instruction to the executive that a sufficient sum be appropriated, without delay, to construct a "Royal Oak" section and that it undergo the same series of experiments under the fire of great guns as the "Warrior" section was subjected to.

When the question is before the House, it would be wise, at the same time, to demand the construction of a similar trial target, representing a section of the armour-plated broadside of the "Enterprise," of which the force of resistance to artillery ought to be tested before Mr. Reed's invention is carried any further. We make no doubt more than one member will be prepared to move a resolution comprising this double proposition; and if it is moved, we are sure Ministers will not venture to oppose it, or if they do, they will be defeated by a large majority.

MACHINERY BELTING.

There is no simpler, or smoother means of communicating motion than that afforded by the noiseless agency of cords, bands, or straps. The very means by which the motion is maintained, namely, by the frictional adhesion between the surfaces of the belt and the pulley, is a safeguard to the whole mechanism; as if any unusual or accidental obstruction should intervene, the belt merely slips, and breakage and accident is thus prevented. When, however, the motion is required to be conveyed in an *exact* ratio, belts are inapplicable, from their tendency to slip. Slipping may, no doubt, be prevented by various means; but it will be shown in the following interesting investigation that, even where the precise action known under the name of slipping does not occur, there is, nevertheless, a certain amount of inaccuracy in the transmission of the speed.

We have extracted the following from the first number of "Annales des Mines," of last year:—

It is generally admitted that in any transmission of movement by means of belts, the speed of the driving shaft is communicated to the shaft driven, at a velocity inversely as the respective diameters of the pullies; of course, supposing that the belt has sufficient initial tension to prevent any slipping.

We shall endeavour to prove that a rigorously exact communication of speed can scarcely ever take place, and that the shaft driven always revolves somewhat slower; and, further, that this diminution of speed is often sufficiently great to require an allowance in calculating the diameters of a set of pullies.

If we suppose a pulley A, communicating motion by means of a belt to a pulley B, fixed on a shaft parallel to that of the pulley A; let R be the radius, and w the angular velocity of the pulley A; and further, R^1 the radius, and w_1 the angular velocity of the pulley B. We will now suppose that a force F is acting at a tangent to the pulley B, and in a contrary direction to the motion.

In order that a uniform movement should take place, the driving portion of the belt must take a tension T, and the strap that is lead a tension t, while the difference of these two tensions $T - t$ must be equal to F. But the belt is made of an elastic substance, continually changing from one tension to another, and thus altering its length, so that if we fix upon any two points of the belt in motion, the distances between these two points will vary with the tension the part under consideration is undergoing. Whatever be the general law of the variation of tension of the strap at the different points, it is evident that the movement of this belt has all the character of *permanent* motion, and that, in consequence, the quantity of matter passing over the different points in the same time is the same; it is necessary, to produce this effect, that the *natural length* of the strap passing at the different points during the same time be constant. We understand by *natural length* of a part of a belt submitted to a certain tension, the length that such a portion of the belt would have if there were no tension. If we call l the *geometrical length* of the belt, at a tension t, rolling itself within a time O, over the pulley B, a *geometrical length*, l^1 of belt at a tension T will unroll itself during the same time, and this length will be such that its *natural length* will be the same as that corresponding to the lapped round part t. It is thus clear that, contrary to the common belief, the *geometrical length* of the part of the belt rolling itself round the pulley during a time O, is less than the geometrical length that unrolls itself during the same time, and, as a consequence, that there is necessarily a slip on the pulley in the direction of the motion.

It will also be seen that the geometrical length of the belt lapped round in the time O, by the pulley A, is larger than the geometrical length that unrolls itself during the same time, and there is, consequently, a slip of the belt in a contrary direction to the motion.

If we express the equality of the *natural lengths* of belting lapped round during a time O by the pullies A and B, we shall have, represented by *a*, the stretching of the unity of length of the belt under the influence of the unity of tension:—

$$\frac{R\,w\,O}{1 + a\,T} = \frac{R^1\,w^1\,O}{1 + a\,t}$$

from which

$$\frac{w^1}{w} = \frac{1 + a\,t}{1 + a\,T} \cdot \frac{R}{R^1}$$

We thus see that the ratio of the speeds is equal to the inverse ratio of the radii multiplied by a co-efficient, that is only equal to unity when these two tensions are equal—that is to say, in case there is no work to be transmitted, or in case the initial tensions of the belt be infinitely great. The speed is thus always more or less diminished, and the means generally adopted—namely, to tighten the belt, and thus increase the initial tension—is a more injurious than useful remedy, as it increases the passive resistances to the transmission of motion. It is easy to determine the average amount of this co-efficient of the diminution of speed. The writer recently made a series of experiments to determine the value of *a*. He found, taking for unity of length the metre, and for unity of tension the kilogramme, that

$$a = \frac{0{\cdot}16^{\text{m.}}}{S}$$

for belts of common leather that had been in use for some time; and

$$a = \frac{0{\cdot}21^{\text{m.}}}{S}$$

for new belts, S representing the section of the belt in square millimetres.

In practice it is generally admitted that a leather belt carries ¼ kilogramme per square millimetre in section, that is to say, that $S = 4\,T$; we would thus have

$$a\,T = \frac{0{\cdot}16}{4}$$

for belts that have been in use for some time, and

$$a\,T = \frac{0{\cdot}21}{4}$$

for new belts.

As to $a\,t$, it is equal to

$$a\,T \times \frac{t}{T}.$$

We can have an approximate value of $\frac{t}{T}$; in fact the strengths of belts are always calculated in such wise that they can resist the tension required to prevent a complete slipping on the drum. We are not now referring to the slipping caused forcibly on the drum by the lengthening of the strap, but of a slipping produced simultaneously in the whole part of the strap rolled on the drum, and resulting in a cessation of motion to the pulley driven. It is generally demonstrated that, to render this complete slipping impossible, we must have (tension) $T < t\,e^{fb}$, f being the co-efficient of friction of the belt on the drum, and b the ratio of the arc of the pulley embraced by the strap to the radius of the pulley. In practice T is generally made $= 0{\cdot}9.\ t\,e^{fb}$, a ratio that, in the case of a leather strap embracing a cast-iron pulley, becomes $T = 2{\cdot}16\ t$. Not to exaggerate the importance of the diminution of speed, we will take $T = 2\,t$, from which

$$a\,t = \frac{a\,T}{2}.$$

We can easily find that the average value of the co-efficient

$$\frac{1 + a\,t}{1 + a\,T}$$

will be—for belts that have been used,

$$\frac{1{\cdot}0225}{1{\cdot}045} = 0{\cdot}978;$$

for new belts,

$$\frac{1{\cdot}0262}{1{\cdot}0525} = 0{\cdot}975.$$

We thus see that the diminution of velocity is about two revolutions for each hundred; this would have but a slight effect on a pair of pulleys; but it is often necessary to use a train of pulleys, and we thus often get very great differences between the real and calculated velocities. It is seen at once that if the coefficient of the diminution of velocity is 0·98 for a single pair of pulleys, it will become, in many cases, equal to the successive powers of 0·98, which are 0.98....0·96....0·94....0·92....0·90, nearly; so that, after a succession of 5 speeds, the loss of velocity is already the tenth of the calculated speed, and that at the end of about 34 speeds, the velocity will be reduced to one half.

The writer has made a great number of experiments to verify these results, and he has determined that, in all cases where the dimensions of the belts do not much depart from those indicated by the calculation, we generally find an average of 0·98 as a coefficient. The formula has also been verified with great certainty by varying the tensions of the same belt. To produce this effect, the writer employed, instead of a leather belt, a band of vulcanized india rubber, a substance in which *a* is pretty nearly equal to $\frac{S}{1}$, by by which it is possible to acquire a very considerable diminution of speed. This band was placed on two pulleys of equal diameter; a small friction break on one of the shafts allowed the resistances to be altered. A series of equal divisions marked on the band permitted the tension to be estimated during the motion. The results were perfectly in accordance with the formula.

From all these considerations it appears that, where it is required to transmit determinate speeds by means of bands and pulleys, it is prudent to increase by about 1-50th the diameter of the driving pulley, or to diminish the diameter of the following pulleys, in the same ratio.

When the power to be transmitted from a prime mover exceeds a certain limit, it is necessary to employ flat belts or straps, working on pulleys, with rims made slightly convex, in a ratio of half an inch per foot of breadth. When the power to be communicated is less than that of two men, cords working in pulleys with round or angular grooves are preferable. Beyond this power, a flat belt may be employed, and when certain limits of power and velocity are exceeded, straps must generally make room for toothed wheels. It is well known that long belts give a much better effect than short belts.

Small flat straps are sometimes used instead of hempen or gut cords for smaller machines; this practice, however, is not in general acceptance. A cord is more easily pieced together than a small narrow strap. A leather strap however, is more elastic than a cord, and is also less hygrometrical or subject to stretch in wet weather. It is important not to stretch too much belts and straps, as there is otherwise much power lost in producing a given effect. It is generally reckoned that from 1 to 2.2 per cent. of the power communicated is lost by the stiffness of a leather belt. An interesting investigation into this matter will be found, 5 Heft of the "Schweitzer Polytechnischen Zeitschrift" for 1861.

In our volume for 1825, p. 69, will be found a valuable letter from Mr. B. Bevan, giving an account of some experiments to ascertain the strength of leather. The practical table this correspondent gives is the following:—

	Cohesion—lbs. per sq. inch.	Modulus of Cohesion in feet.	Ratio of Extension by half breaking weight.
Calves skin	1,890	5,050	0·165
Sheep skin (basil) ...	1,610	5,600	0·191
Horse skin (white) ...	4,000	11,000	0·187
Horse skin (Russ) ...	3,200	7,000	—
Horse skin (Cordovan)	1,680	3,720	—
Cow skin	3,981	10,049	0·22

The "modulus of cohesion" is the length in feet of leather required to break its own cohesion, or tear it asunder.

Rule.—To find the weight necessary to break or tear asunder any strip of leather, it is only necessary to ascertain the weight of one foot in length in lbs. and decimals, and multiply the modulus in feet by the weight so found; the product will be the greatest load the strap will bear, even when the leather is new; but not more than one-third or one-fourth of the weight thus found should be trusted for any considerable time.

The following are some neat formulæ appearing in "Molesworth's Pocket-book of Engineering Formulæ." They are for ordinary leather belting used in common cases, at not very high speeds:—

V = velocity of belt, in feet per minute.

H P = horse-power (actual) transmitted by belt.

$$x = \frac{33000 \text{ H P}}{\text{V}}$$

S = strain on belting, in lbs.

W = width of single belting (3-16th thick) in inches.

$$\text{S} = x + \frac{x}{k}$$

$$\text{W} = \frac{\text{S}}{50}$$

k = ·09 when portion of driven pulley embraced by belt = 0·40 circumference.

k = 1·3 when portion of driven pulley embraced by belt = 0·50 circumference.

k = 1·6 when portion of driven pulley embraced by belt = 0·60 circumference.

For double-belting the width = W × 0·6.

Approximate rule for single-belting 3-16th thick.

$$\text{W} = \frac{1100 \text{ H P}}{\text{V.}}$$

An empirical rule for ascertaining the width of pulley straps that we know to be in use by some good practical men, is as follows:—

$$\text{B} = \frac{31{\cdot}4 \text{ N}}{n\,d}$$

in which formula, B is the width of strap required (the thickness of the leather being taken at 3-16th); N is the number of horse-power; n is the number of revolutions; and d is the diameter of the pulley.

The most generally used mode of connecting the ends of leather straps is by means of laces or thongs of leather. Other methods have been tried, such as glueing the ends together, or using hooks or clasps. Rivets, studs, and screws have, to some extent, been employed. Pegs have also been proposed (*Vide* Patent No. 3163, 1860).

The following is a *recipe* for a composition or glue that will stick the ends of belts together. We believe that it has been tolerably successful, and it is said to have stood 4-horse power when carefully made, and similarly applied. Take:—

8 parts of the best glue,
4 parts of isinglass,
2 parts of gum arabic.

The glue must be boiled down, and stirred up till it assumes a tough, thick consistency. Then pour in three-fourths of spirits of wine, and let it dissolve the mass. The isinglass, previously dissolved in warm water, is now mixed with the above and stirred up together. Last of all, the gum arabic, dissolved in water, is poured on, the whole carefully mixed together, and the composition is then fit for use.

As might be expected, from the fact of an article being so greatly in demand as leather belting, there are large quantities of cuttings and waste annually evolved from the manufacturer of these useful mechanical organs. Most inventors who have found the means to utilize what was previously refuse, have deservedly accumulated large fortunes. Accordingly, in France and America, attempts, more or less successful, have been made to utilize the waste cuttings of the manufacturers of leather articles. We believe that at Abington, in the State of Massachussets, there is a steam engine of about 8-horse power, solely employed in grinding and pulverizing the waste cuttings usually thrown away or burnt by saddlers, shoemakers, &c. The waste pieces are reduced to powder, and are then mixed with vegetable gums and other substances, by which means the whole obtains such cohesive power that the mass becomes a kind of soluble leather. In a short time the composition acquires sufficient consistency to allow itself to be passed through rollers, and thus to be brought to the required thickness.

Other and more direct means have been attempted to utilize small waste pieces of good leather. Monsieur Roullier, of Paris, himself a manufacturer of artificial leather, has made certain peculiar belts of waste leather cuttings, and some were exhibited at work in the Western Annexe of the International Exhibition. We described his plan in our number for September 19th, 1862.

These "courroies en cuir articules," as they are called by the French inventor, consist of a number of small flat links of 3-16th leather united by long pins of the breadth of the band. The pins have heads, and are rivetted or clenched back on a washer at the other end. In a 3-in. broad specimen of this description of belting, the pins are about ⅛ of an inch in diameter, and about half an inch from centre to centre. The belt working in the French part of the Western Annexe appeared to stand the strain very well. The links of leather are stamped out and the holes punched in by a machine, and they are threaded on to the pins by workwomen. Mons. Roullier is said to have an establishment in Paris employing three hundred workmen, and he can deliver one hundred metres per day of his peculiar belting. He has recently used small links of zinc between those of leather. It appears to us that an objection will be found in this belting from the fact that there is necessarily a tendency in the joint-pins to bend to the curve of the pulley, and a continuation of this action would naturally lead to the breakage of the joint-pins.

A very remarkable and important description of belting, the invention of Mr. William Clissold, of Dudbridge, Gloucester, was exhibited at work in the Belgium Department of the Western Annexe of the International Exhibition. These bevel-edged belts were first patented in 1860, May 22nd; but not being found sufficiently strong, the *continuous* bevel-edged belts were altered into a kind of chain of separate links. The wedge-shaped links are made of strips of leather coiled up to the ordinary figure of a link, and these links are connected together by link plates carrying a stud at either end, which studs enter the adjacent links and hold them together. This description of belt, or rather chain, has acquired great importance from its being used by Mr. John Fowler to communicate the motion of an ordinary portable engine to the moveable clip drum in front; by which means the ordinary portable engine can be used in ploughing upon the "direct acting" system. We also saw some small bands entirely of cotton, at Messrs. Apperley and Clissold's stand in the Western Annexe.

An ingenious and efficient leather belt is manufactured by Messrs. Bryant and Cogan, Broadmead, Bristol, according to the patent of Mr. Haines (No. 406, 1860). These bands are built up of narrow leather strips or fillets, each piece being of the thickness of the intended driving strap, and they are placed side by side with the cut edges of the leather placed outside. The straps are made to break joint, and holes are bored through them at intervals from edge to edge of the strap, and the straps are then fastened together by pieces of wire. It will thus be seen that a description of band like this may be made of any length or thickness, without laps, cross-joints, &c. These bands may also be used much slacker than the common strap, as the rough surface ensures a greater amount of adhesion. The band is made a little shorter than the required length, in order that two iron shackles may be kept a few inches apart. As the band stretches, the shackles may be gradually drawn closer, by means of wide laces, until they meet: should the band afterwards stretch, one of the shackles may be set further back by filing off the bur at the end of the pin, cutting back the leather, and inserting the pin through the shackle into the next hole. One of these patent bands was exhibited at work in the Belgium Department of the International Exhibition.

There were several machines in the Western Annexe of the International Exhibition driven by a description of leather belt manufactured by Messrs. Sampson, of Stroud. From its peculiar make no cross joint was required in a length under 200 ft. It was formed of two narrow strips of thick leather, and three narrow slips were sewn on at the back.

There was a slip sewn to each edge, and an additional third strip at the joint in the middle. We have heard practical men say that this belt gave remarkably good results.

We also noticed some excellent double leather bands in the North-East Court of the Eastern Annexe of the International Exhibition. They were exhibited by Webb and Son, of Stowmarket. One of the double bands exhibited was 14 in. in breadth. There were also some edged and single belts. Several patents have also been recently taken out for improvements in treating hides and skins for machinery belting.

Many engineers probably still think that "there is nothing like leather" for straps. Nevertheless, those remarkable vegetable gums, caoutchouc and gutta percha, have been employed in various ways, and with great success, in the manufacture of belting. A large number of these belts were at work in the Western Annexe of the International Exhibition. It is to be regretted that the many extensive manufacturers of these important mechanical agents have not instituted a series of careful experiments giving the breaking strain, coefficient of friction, loss by stiffness, &c., of india rubber and gutta percha belts, as compared with those of leather.

Most of the india-rubber belting sold seems to be very similar in appearance; but the processes of manufacture probably differ. Mr. S. T. Parmelie, of Edinburgh, patented in 1858 (No. 777) certain machinery and a peculiar process for manufacturing belting. The belting is made of several layers of woven material, cut into strips of the width required. The whole is then passed between the peripheries of two rolling cylinders united by an endless metallic band, in such a manner as to admit of the belting being passed between one of the cylinders enclosed within a headed chamber and the endless metallic band. The cylinders are provided with one or more grooves corresponding to the required width of the belting. These bands, which are said to give good results, are manufactured by the North British Rubber Company, Castle Mills, Edinburgh. The woven material that affords the basis for the india-rubber, is said to be made of Sea Island cotton. The material is claimed to be superior to leather for damp places, and to gutta percha in situations subject to variations of temperature. The bands are joined together with laces, or by an india-rubber lap and screws.

The well-known firms of Warne and Co., Gresham-street, Macintosh and Co., of Manchester, Hancock, Goswell-mews, and Moses, Son, and Davis, Cheapside, are all manufacturers of india-rubber belting, so that it will be seen what an important demand already exists for this description of band.

The belting manufactured by Messrs. Spill, of Stepney-green, according to patent No. 2550, date 1859, consists of a band of steel wire, covered with several strands of hempen cord, previously passed through a solution of either india-rubber, gutta percha, glue, or drying oils, &c. After the strands have been applied the whole is carried through rollers. Any number of these smaller bands are then placed as warps in a loom, and similar materials to those covering the steel bands are then used as the weft, so that the whole is woven together. The band is afterwards again passed through rollers, and (either before or after this operation) it is coated with caoutchouc. This invention is also remarkably ingenious.

We have heard some good accounts of the gutta percha bands manufactured by the company of the same name, of City-road, in the metropolis. They are largely used by Truman, Hanbury, Buxton, and Co., as some of the advantages of these bands consist in their non-susceptibility of injury from greasy or chemical substances, and the ease with which the joint may be made. The following are the directions given by the manufacturers for making the joints:—

"Cut the ends of the band obliquely at an angle 30 or 40 degrees, making the band rather shorter than the length required. Secure one end to a board or bench by a clamp or a couple of nails. Having heated a piece of iron (say one inch broad and half an inch thick) to the temperature of a laundress's smoothing iron, so that it will soften the gutta percha without burning or discolouring it, place the iron between the cut edges of the band, pressing them against it (keeping the band always in a straight direction) until the edges are thoroughly softened, and in a sticky state; then remove the iron and press the two edges together as closely as possible, after which a couple of nails may be driven into the loose end of the band, to keep it in its place. The ridge or burr may be pressed down as much as possible into the substance of the band, by a heavy weight or by means of a clamp, so as to make a smooth joint. A band of ordinary thickness will be ready for use in ten or fifteen minutes, or sooner if cold water be applied. Flat joints may be made in like manner, by shaving down the ends a little (so as, when laid one on the other, not to be much thicker than the band), heating the surface of the splices, and pressing them together by a weight or clamp. Avoid heating the band throughout. Pare the edges when cold." Cross bands made of gutta percha must be separated by a roller, or a fixed round iron bar, if there be much friction or rapid motion.

The West Ham Gutta Percha Company are also manufacturers of similar bands.

An interesting description of belting was exhibited in the American department of the International Exhibition. It was made chiefly of wool, and the surface of the belt was covered with a resinous cement. We saw a small piece that had been in use for two years and a half on a heavy cloth loom in the States. We believe that some belting of this material is working some looms in the Mills of Smith, Brothers, and Co., of Heywood, Lancashire.

II.

ENGINEERING LITERATURE.

The author of an excellent and well-known work on bridges, Mr. William Humber, Assoc.Inst.C.E., and Memb.Inst.M.E., is now editing a new engineering monthly serial.[*] The two numbers we have seen, for the months of February and March respectively, contain an account, fully illustrated with steel engravings, of the roof of the Victoria station of the London, Brighton, and South Coast Railways. We consider that a greater number of dimensions might have been given on the detail drawings, as also more centre lines. Centre lines do not increase the beauty of a mechanical drawing, but they add considerably to its intelligibility and usefulness. The Editor proposes to give illustrated descriptions, as the work proceeds, of the London, Chatham, and Dover, and Great Western railways; the Charing-cross railway station, with full detail drawings of the roofs; also the roof of the Amsterdam station of the Dutch Rhenish railway; the Metropolitan Railway; the High Level Sewer, &c., &c.

The points of contact between practical engineering and chemistry are so numerous that an engineer can scarcely practise with any success without some knowledge of chemistry. More especially by those whose education dates from the "pre-scientific era" would a good chemical encyclopædia be a great boon. This is attempted to be furnished in a work of which we have seen the first part; written by the editor of "The Journal of the Chemical Society."[*] We understand that the work was originally intended to be issued as an edition of Ure's well-known "Dictionary of Chemistry and Mineralogy," but the great progress made in physical and chemical sciences since the date of the last edition of that work (1831) has required a complete refounding of the book. The Editor has freely availed himself of the works of the German *savants*: the best chemists in the world. In order to render the work more generally intelligible, the formulæ of the older or dualistic system are also given, and are printed in *italics*. The centigrade scale is also used.

We always hail with satisfaction the appearance of a practical engineer in the literary arena. From various causes, engineers are so chary of writing, or even of compiling, that invaluable records of the life-experience of many able men have been often lost to the profession. The principal assistant engineer of the Ceylon Railway, Mr. G. L. Molesworth, has lately published an excellent and compendious Vade-mecum for the use of engineers.[†] The usual so-called "Engineers' Pocket Books" require rather a carpet-bag than a pocket to carry them about, while at the same time they discuss subjects with too little amplitude for a leisurely reference. This small book only measures 5 × 3¼ × ½, and yet contains 220 pages, besides some blank leaves; the whole closed by an elastic band. Perhaps it would have been better if the blank leaves had been distributed through the work, so that each possessor could note down additional formulæ to those in the book; as it is impossible to expect that such a small work could meet every special case. This small Vade-mecum is divided into three parts, touching on nearly 500 subjects connected—1, with Civil Engineering; 2, Mechanical Engineering; 3, An Appendix. The part on Civil Engineering contains 62 pages, and gives the formulæ applicable to surveying, earthwork, beams, roofs, railways (12 pages), waterworks, warming, &c. &c. That on Mechanical Engineering consists of 84 pages, and as per synopsis it touches on gravity, mechanical centres and powers, millwork, teeth of wheels, shafting, belting, alloys, solders, and workshop recipes (very good), steam boilers and steam engines, waterwheels, turbines, &c., windmills, paddle and screw steamers, and miscellaneous machinery. The Appendix gives the usual aids to calculation, such as weights and measures, English and foreign, logarithms, trigonometrical formulæ, squares, cubes, powers, roots, and reciprocals, &c.

II.

CARRIAGEWAYS AND FOOTPATHS.

Sir John Scott Lillie, Knight and Companion of the Military Order of the Bath, of 105, Pall-mall, has lately taken out a patent for the construction of carriageways and footways.

These improvements consist in the construction of carriageways or footways with gutta percha, asphalte, asphalted felt, wood, or other suitable material or combination of such materials rendered impervious to water by a solution of caoutchouc or other solution suitable for that purpose. When such carriageways are intended for heavy traffic, he causes the same to be studded with metallic bolts, or with bars of iron, or rows of metallic bolts or studs; such rows to be placed transversely or at right angles to the line of traffic, at intervals of not less than three inches apart.

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[*] A Record of the Progress of Modern Engineering; containing Civil, Mechanical, Marine, Hydraulic, Railway, Bridge, and other Engineering Works, &c. Edited by William Humber, Assoc.Inst.C.E.—E. and J. N. Spon, 16, Bucklersbury. 4s. 6d. per part, or £2 2s. per annum.

[*] A Dictionary of Chemistry and the Allied Branches of other Sciences. Founded on that of the late Dr. Ure. By Henry Watts, B.A., F.C.S., assisted by eminent contributors. To be completed in 16 parts, price 5s. each.

[†] Pocket-book of Useful Formulæ and Memoranda for Civil and Mechanical Engineers. By Guilford L. Molesworth, Memb.Inst.C.E.—London: E. and J. N. Spon, Bucklersbury. 4s. 6d.

ONIONS' PORTABLE FORGE.

FIG. 1.

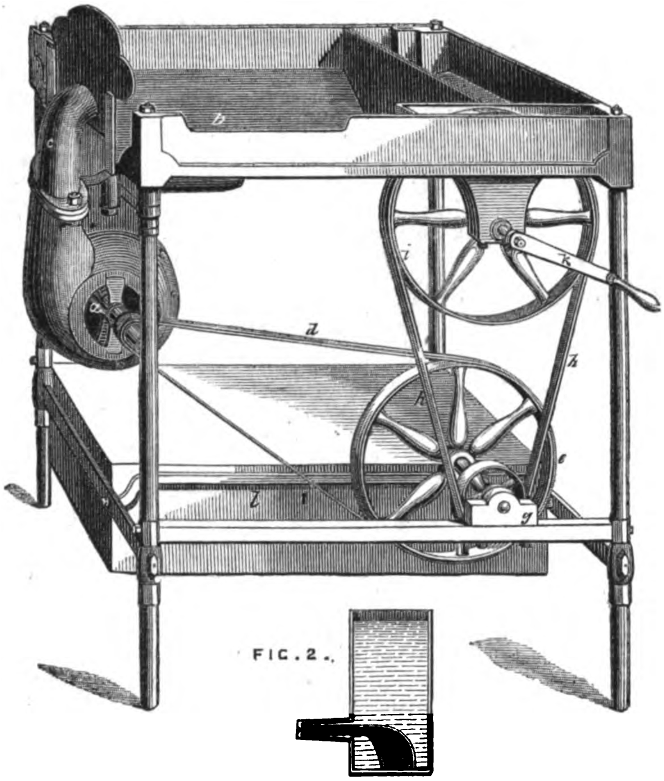


FIG. 2.

ONIONS' PORTABLE FORGE.

A **very** compact arrangement for a portable forge will be found described and illustrated as above. It is patented by Mr. J. Collingwood Onions, of Birmingham.

The invention consists in the employment of a fan for creating the blast, and in the arrangement of the parts hereafter described. The fan is placed under the hearth and at the back end of the forge, and the blast is led up into the fuel through a bent tuyere or pipe in which the upper part of the of the fan case is made to terminate; and the chest or box for holding tools is placed within the frame of the forge, and below the hearth. Motion is communicated to the fan by belts passed over pulleys driven by a crank handle or by toothed gear.

Fig. 1 of the accompanying drawings is an isometrical perspective view of a portable forge fitted according to this invention. *a* is the fan set beneath the hearth *b* of the forge; *c* is the bent pipe or tuyere, extending upwards as shown, for guiding the blast to the hearth. The tuyere is carried through a cistern containing water, whereby it is kept cool, as shown in the detached view below. Quick rotary motion is communicated to the fan *a*, through a strap *d*, passing round a wheel *e*, which is on a shaft carrying a pulley *f*, free to revolve in bearings in the frame *g* of the forge; *h* is another strap passing round the pulley *f* and a wheel *i* above, rotary motion being communicated to it through a handle *k*, or otherwise; *l* is a chest for holding tools placed and secured within the frame.

WALKER'S HARPOON SHIP-LOG AND SOUNDING-MACHINE.

Messrs. Walker of Oxford-street, Birmingham, have protected by letters patent two inventions—namely, a Harpoon Ship-log, and a Harpoon Sounding-machine.

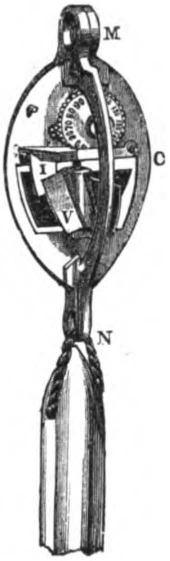
THE HARPOON LOG

Is an improvement on the older instrument, so well known as Massey's; for the rotator and the wheel-work registering the distance sailed are all in one instrument, instead of being distinct, as was formerly the case. By this arrangement the whole is rendered much more compact, and acts with greater accuracy at all speeds than when the two parts were distinct, and merely connected by an intevening cord. It is hardly necessary to state that, when in use, the log is attached to a line and thrown into the water, and is pulled onward by the advance of the vessel.

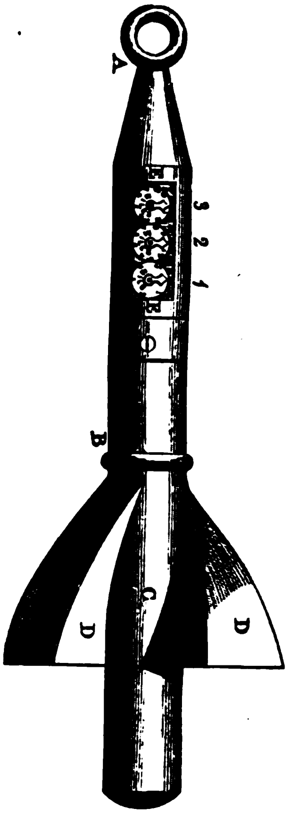
The part marked A and B in the accompanying figure does not revolve as it passes through the water, but contains the wheel-work for registering the number of revolutions of the rotator C, which is caused to revolve, as it passes through the water by the oblique position of the vanes D D. The angle of the vanes is so adjusted to the wheel-work of the register, that when the machine has passed through one mile, the finger of the first dial will have made one revolution; the finger of dial No. 2 will have made one-tenth of a revolution, and index No. 3 will have made one-hundredth of a revolution, or, in other words, the first index goes once round in one mile, the second index in ten miles, and the third in 100 miles. It will be seen that in this log the register and rotator are combined, the rotator being a continuation of the register or part that holds the wheel-work. By this arrangement, not only is the machine made more compact, but the end of the rotator is protected from all front-end pressure, thus considerably reducing the friction, and thereby enabling the log to register *with equal accuracy at all speeds*. Before throwing the log overboard, the finger or indexes, 1, 2, 3, should be placed at the beginning of their points of registry—namely, the first finger to 1, the second to 10, and the third to 100, then turn the outer loose tube E E round until the dials are covered. The rotators are in all cases made of solid seamless tube to ensure their being water-tight.

THE HARPOON SOUNDING-MACHINE

can be used with any common deep-sea lead. The rotator and wheel-work are completely protected from injury by the frame. When used, an ordinary deep-sea lead is attached to the lower end of the instrument by a rope N, the sounding line being fastened at the loop-hole M. The rotator in the centre of the machine it made to revolve, whilst descending, by the action of the water on its inclined vanes V; the locking piece I, being kept up out of the way by the resistance of the water. On reaching the bottom, the lock falls between the vanes of the rotator, and prevents it from registering while being drawn up. The first or small wheel which works in the worm makes one revolution in ten fathoms. The second or large wheel (shown in the engraving) goes once round in 150 fathoms. Before throwing out the machine, when using it, lift up the locking piece and turn the rotator until the small wheel stands at 10, and then, by means of the milled knob, turn the dial plate of the large wheel to 150, and the number of divisions the wheels will have moved when the machine is brought up again will show the depth. If required, these machines can be made to register any number of fathoms, or even miles, but for ordinary soundings 150 fathoms is considered sufficient.



Walker's Harpoon Sounding Machine.

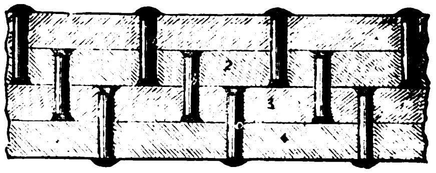


Walker's Harpoon Log.

CONSTRUCTIONS OF ARMOUR PLATING FOR VESSELS AND FORTS.

The annexed engraving shows a description of armour plating for vessels, and forts, &c., lately patented in this country by Mr. J. H. Johnson, being a communication from Filip Bergendal, of Sweden.

It consists in making armour plates of several



laminæ; but in lieu of connecting the whole of such plates together by bolts passing through the entire series, it is proposed to couple only the contiguous ones—thus, if four plates or laminæ be employed, No. 1 will be bolted, rivetted, or otherwise secured to No. 2, which in its turn is similarly secured to No. 3; this plate being secured to No. 4 plate, and so on throughout any desired number of plates. The accompanying drawing represents a section of an armour plate constructed in the manner above described.

1, 2, 3, 4 are the several component plates secured each to its adjoining plate by the three series of rivets *a*, *b*, and *c*. Any number of plates may be thus rivetted or bolted together to produce an armour plate of the strength desired.

ADMIRAL HALSTEAD ON MR. REED'S SHIPS.

Admiral Halstead has addressed an able letter to the *Daily News* on the "Enterprise" and other ships. He compares the "details of Capt. Coles's invention, and those of the plan derived from it," in the following language:—

Her cupola, instead of circular, is square; instead of revolving, it is fixed; instead of the form which gives greatest strength, it has that which gives least; instead of the form which requires least material in construction, it has that which requires most; instead of giving most protection with the lightest weight, it gives a less protection with a heavier; instead of doing most work with fewest guns, it demands twice as many guns to do no more than half the work; instead of carrying its own and its guns' weights centrally, so as to injure the ship's stability least, it carries them out to the extreme beam, where they will injure it most; instead of giving free intercourse from end to end of the working deck, it entirely obstructs intercourse by a barrier 30 feet wide and 7 feet high.

On the great question now so rapidly rising between central and broadside armament, the "Enterprise" mode of cupola-ship as jealously retains every disadvantage of the old system, as the true cupola gives free scope to every advantage of the new. For instance:—

Applying the proofs obtained from the trusty trials of Captain Coles's invention in September, 1861, when the gun from the cupola was found to fire with more certainty, and twice as rapidly, as the equal gun fired from a broadside port of the same ship, it follows, that either of the two pair of broadside guns of the "Enterprise" must be far from a match for the one pair of guns mounted in a true cupola. And even when fighting "both sides," since the true cupola, retaining its other advantages, can always revolve its fighting face from broadside to broadside within the time required for loading its guns, while the imitation can only fight its two pair of guns with half the rapidity of one pair, it follows again, that all the increased weight, labour, expense, complication, and liability to damage, in such ships as the "Enterprise," have to be incurred without a single concurrent advantage to compensate for what thus seems to be so ill-considered and retrograde a choice. On the contrary, while each of the two pair of guns in the imitation can command on each broadside a training arc of only 60 degs., it follows that the ship herself must be left without protection from broadside to broadside round by the bows, and the same again round by the stern, throughout two great arcs each of 120 degs., or nearly 11 points of the compass, within which points an enemy will find all but entire impunity. Let that enemy be a cupola-ship "Dexter," working her single pair of guns all round the compass, with all the advantages shown in the September trials, and it needs no prophet to foretell the early fate of her of the Bar Sinister. But, additionally, while the true cupola-ship can protect herself with all her guns all round the compass, without change of course or position, the "Enterprise," in order to protect herself throughout these 240 degs., or more than 21 out of the 32 points of the compass, can do so only by a change of course or position, which may not always be safe, and perhaps not even practicable.

I ought, however, to say, that, besides the four fixed broadside ports, there are narrow openings like ports—two looking forward and two looking aft—out of the very corners of the "Enterprise's" fighting-box, apparently to afford ingress and egress with the deck. A gun taken from the broadside might, on emergency, fire out of these openings at an angle of about 30 degs. from line of keel; but as no gun could be "fought" from them in any ordinary meaning of that word, their existence barely qualifies the entire impunity of the two great arcs described.

Proceeding to compare the respective features of the two modes of cupolas when actually under fire, we see as follows, viz.—the one presents a minimum surface to be aimed at, the other a maximum. The one deflects all ordinary shot from off a curvilinear surface, the other presents a rectangular face for receiving them in full force. The one opposes the penetration of any shot or shell with the increased thickness of wall due to its angle of obliquity; the other can oppose the full power of penetration by missiles fired direct, with the thickness of its wall only. Under a plunging fire, the one retains its advantages of impenetrability in size, deflection, and thickness, but exposes its top aperture; the other, with an equal aperture (for hoisting the guns in and out) exposes a penetrable flat roof, 36 ft. by 30, composed of 18-in. teak, covered with only half-inch iron.

Referring, in both cases, "strength of structure," irrespective of form, to the common standard of the "Warrior" target, we find as follows, viz.—the true cupolas of Captain Coles, now building, have one-inch thicker armour than the target, but the same backing and same inner skin. The "Enterprise" cupola has the same 4½-inch armour and the same 18-inch backing as the target, but no inner skin; so that the true cupola is stronger in structure as in form than either its imitation or the target; and the imitation is weaker in structure than both. Both in the target and true cupola the effect of the inner skin of iron is to prevent ignition of the wooden backing by shells, and intercept splinters; therefore the omission of this skin from the imitation renders it more fatal and combustible than either.

On the other great question now so rapidly rising—viz., the ability of ships to use guns far heavier than formerly, the "Enterprise" mode of cupola altogether ceases to be capable of comparison. If, indeed, the 95-cwt. solid shot 68-pounder be fit for fighting a sustained action at all, it certainly limits the weight of gun which is practicable upon the old broadside system of armament; whereas Captain Coles's cupola presents us, as regards both carrying and fighting, with the means of using at sea the heaviest reasonable gun yet projected, with a facility unknown throughout the broadside period. And on the all-important point of "training," whether it be for extent, ease, accuracy, or steady motion, it constitutes in effect the most perfect gun-carriage for heavy ordnance yet produced.

It will be noted that the professional judgment thus far offered has been strictly limited to the more direct mode and means provided in the "Enterprise" for fighting a successful action, and I resist as unnecessary all temptation to treat on those other less direct but important peculiarities she undoubtedly displays. For it will be granted that, whether large or small, armoured or bare, every war-ship, even if successfully designed for taking a special sphere of service, if she do not also take with her to that sphere the means of a successful fight against an equal foe, she may indeed be a bugbear to semi-savages, but for the strife of civilized warfare she becomes a great mistake.

I need, then, carry comparisons no further. I have, I think, adduced enough to prove that, under whatever motive or mere impulse the "Enterprise" was ordered, the study of her design could never have included any practical comprehension whatever of the special adaptations to modern progress which characterize that true invention she assumes to emulate, and doubtless was intended to surpass and supersede. But, I would ask, have I not also shown enough to prove further that sooner or later the day of trial must come when so many grave aberrations from sound practical judgment must inevitably present themselves for alteration and remedy; and that the larger the fleet of such ships to be sanctioned by the Estimates of this year, the larger the items for costly "conversion" stored up for those of the future? The "Enterprise" is now in that state when with least change of plan she may be made to cease exposing so many serious contrasts on so many fatal points, and when the wisdom of consulting for her immediate equipment with a true cupola mounting, say, a pair of the new Whitworth 150-pounders, will be attended with least loss of departmental—perhaps governmental—credit, as well as public money; while the country will the sooner possess an exemplar iron-clad small craft of true modern capabilities, instead of a vessel which on the very first comparative test to which she can be put is thus proved to be, however well intended, but a retrograde and inferior imitation.

Admiral Halstead then gives good reasons why experiments should precede shipbuilding on a novel plan:—Not a pound of powder has, he says, yet been burnt in proof of what protection could be given against modern missiles by that upper deck 14 in. of wood, and that main deck ⅝ in. of iron, which alone intervene between an enemy's shot, and no less than one-third of the guns and guns' crews of the "Black Prince," "Warrior," and sisterhood. But if the guidance of such powder-proof had been sought *before building* in 1859, when it must have shown the incongruity of such structures, we should not see the alterations now carrying out on the sister-ship "Achilles," at Chatham, as the sure guarantee and precursor of that same yet more costly operation to be performed in due time on the above two and the remaining four of the same incongruous family. An operation all the more sure, because so late as February, 1861, it was officially fixed that no alteration whatever should take place in the "Achilles," the actual drawings of the "Warrior" having been sent to Chatham for the express purpose of building her as "an exactly similar ship."

Again, even the armoured portion of the "Warrior" and her sisters was constructed on a mere guess. Not a pound of powder was burnt to prove beforehand if 4½-inch armour and 18 in. of teak, with an inner skin of ⅝ iron, would or would not be an equal substitute for the standard strength adopted from the "Trusty's" 4-inch armour and 25 in. of oak. And not till October 1861, when seven armour ships were thus built or building, did the trials of the "Warrior" target reveal to the guessers that their guess was a good one.

Again, not a pound of powder was burnt *before building*, to prove if the next guess of substituting 5½-inch armour with but 9-inch teak, would or would not give to the "Minotaur," "Agincourt," and "Northumberland," the same resistance as the "Warrior;" and this time the guess was a bad one. The late 12-ton 150-pounder Armstrong smooth-bore, which on the 8th of April and 20th of May last took so slight effect on the "Warrior" target, put its shot completely through the target of the "Monotaur" on the 7th of July following. But these three ships, representing when complete about £500,000 each, and they therefore remain as originally guessed at, to afford to those who fight them a less protection than their smaller and less expensive predecessors; as well as monuments to prove that mere guess-work may guide us to progress in the wrong direction.

Need I add that a few pounds, perhaps even cwts., of powder burnt *beforehand* to guide us to a safe choice of guns in 1858, must have saved the millions of money and loss of years which the Gun-proof Committee, so recently and tardily appointed, can never now redeem. For all the time and money so devotedly spent to uphold a choice, then so preferentially blind, finds our empire in 1863 with the great national land and sea services, so far as regards power of artillery against armour ships, and perhaps even in the field, practically gunless.—See Parliamentary Report on Ordnance, July, 1862, question 2,278; and compare with Shoeburyness trials of September the 16th and 25th, and November the 18th, 1862.

These, then are all grave warnings; all are of one nature; all point in one direction; all present to the country bills of cost equally as heavy as they ought to have been needless. Why so recklessly add to their number?

No less than four of this new species of cupola-ship, each of a different class, are already building. They vary from the 1000-ton "Enterprise," through the "Favourite" and "Research," up to the "Zealous" of 3,700 tons, with but four pair of guns upon each fighting face, and being quasi-armour-ships, £500,000 is a very low estimate for their cost; yet again, not one pound of powder has been burnt to prove *beforehand* the worth of one of them. Nor be it assumed that this new species can alone furnish us with small craft. There is now building in the Clyde a true cupola-ship for the Danes, armoured from end to end, instead of only very partially like the "Enterprise;" armed with two double-barrelled cupolas, and therefore of double her broadside force; with the same draft of water, and a burthen of 1,200 tons. If this vessel should realise all the cupola advantages of the September trials of 1861, then she must prove more than a match for the "Favourite" of 2,200 tons, also mounting but two pair of broadside guns on each fighting face of her fixed rectangular cupola, and roundly 1,000 tons larger than the Dane.

As before with comparisons, so now again with facts. I believe I have adduced enough to prove that guess-work and blind choice are bad and expensive means for solving those great physical problems which still surround us; and, instead of following such false guides any further, that it is far safer and more defensible to be led by the true light obtainable on our further progress from *proof as far as practicable*.

Deal, then, with this imitation in its present inchoate state, as the original was well and wisely dealt with before it was at all adopted. Utilise once more the "Trusty;" erect on her deck a *fac simile* of the "Enterprise" mode of rectangular cupola, and subject it to the same double proof of its offensive and defensive powers by as heavy and sustained a fire, from and against, as Captain Coles's invention underwent in September, 1861. If it come forth victorious, all unfavourable comparisons herein stated become mere words; but, if such practical proof be once more refused, then those comparisons must be held to be thereby substantiated, and known to be incapable of public or private refutation, except *by mere words*. In which case, those who rule highest in such matters will, it is to be trusted, see fit to direct, for the sake both of the country and its navy, that the further building of such ships should at once cease, as being incapable, in equal contest, of affording to those who must fight them any confidence of success.

SELLERS' PLANING MACHINES.

Mr. Sellers, of Philadelphia, the patentee this country of the well known screw-cutting machines, manufactured by Messrs. Sharpe, Stewart, and Co., of the Atlas Works, Manchester, has lately patented some important improvements in the construction of planing machines. We will more particularly describe his novel mode of working the rack on the planing machine table.

The nature of this invention consists in furnishing the table of the machine with a rack of the ordinary construction, and in operating this rack by screw gearing, which enables the driving shaft to cross the bed diagonally, passing out in a position near enough to the upright which carries the side rest and cutting tool to enable the driving belts to be within reach of the operator, and it also consists in transmitting and arresting motion by means of a ratchet, which must be the driver, and a double pawl attached to the object to be driven, so that while retained in gear with the ratchet, motion will be imparted to the object to be driven until by the interposition of a suitable stop the continuous motion of the ratchet will lift the pawl out of gear.

SELLERS' PLANING MACHINES.

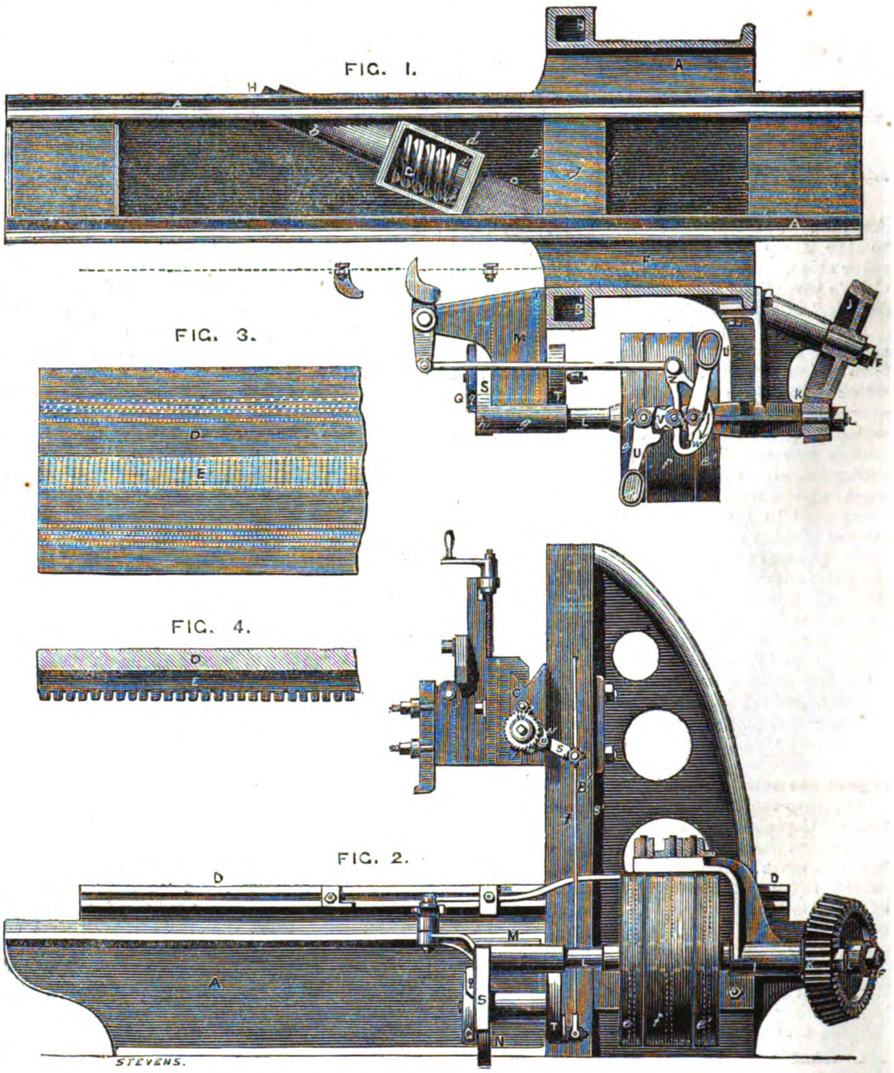


Fig. 1 represents a side elevation of a planing machine constructed according to this invention; fig. 2 is a plan of the machine with the table removed to show more clearly the parts below the same; fig 3 is a detached plan of a portion of the table; fig 4 is a section of the same.

A is the bed of the machine, to opposite projections of which are bolted the uprights B and B^1, carrying the slide C. The top of the bed A is provided with V-shaped grooves extending its entire length, in which slides the table D, it being provided with downward projecting ribs *a*, *a*, of corresponding bevel to the V-grooves. To the under side of the table and central between the slides *a*, *a*, and extending its entire length, is attached the rack E. Motion is communicated to the table by means of a worm upon a shaft F, crossing the bed diagonally (in the manner best seen at fig. 3), which worm G gears with the rack E. The driving shaft F revolves in bearings *b* and *c*, which are cast in the bed and connected by a trough *d*, serving as a receptacle for the lubricating material in which the worm G is kept constantly running. The end of shaft F in the bearing *b* receives a portion of the thrust from the motion of the table, under the cut against a step H, whilst a portion of the lesser thrust during the return motion of the table is received against the hardened collars d^1 and d^2, at the other end of G, d^1 being fastened against the end of bearing *c* and d_2, attached to the shaft F; the remainder and smaller portion of this thrust is received against the sides of the bearings *b* and *c*. The shaft F is at the end opposite to the step H, supported in a third bearing attached to a stand I, and outside of this bearing it is fitted with a bevel wheel J, which is driven from a pinion K on the pulley-shaft L, the latter having the usual fast pulley *f*, and loose pulleys *e* and e^1, transmitting alternately, by means of an open and crossed belt from the counter shaft above, the power for the reciprocating movement of the table. Upon reference to fig. 3, it will be seen that the position of the teeth in the rack of the table slightly varies from a right angle to the line of motion; this is done to counterbalance the side pressure which would otherwise be produced upon the table by the action of the screw under cut.

The advantages of the improvements, as regards facilities for bracing the bed in the parts under strain from the cut, will be obvious on reference to fig. 1. Here it will be seen that the sides of the bed directly between the posts and the uprights B and B are firmly braced by a box-shaped connection consisting of the vertical ribs *i*, *i*, and top and bottom plates *j* and *j*. To give the utmost capacity to the machine, it is very desirable to bring the driving belts clear of the uprights and within reach of the operator for convenience, and to accomplish this in the ordinary rack planer the space between the uprights is usually occupied by the gearing, and admits of a very narrow brace, and in the screw planer this brace must be much diminished in height to give room for the screw, so that the strengthening of the most vital part of the machine is rendered very difficult. In addition to the above braces, the bearings *b* and *c* of the shaft F, united by means of the trough *d*, connect the two sides of the bed in such a manner as effectually to strengthen it, and enable it to resist the end thrust of the shaft F.

HUMPHRYS'S MARINE ENGINES.

FIG. 1.

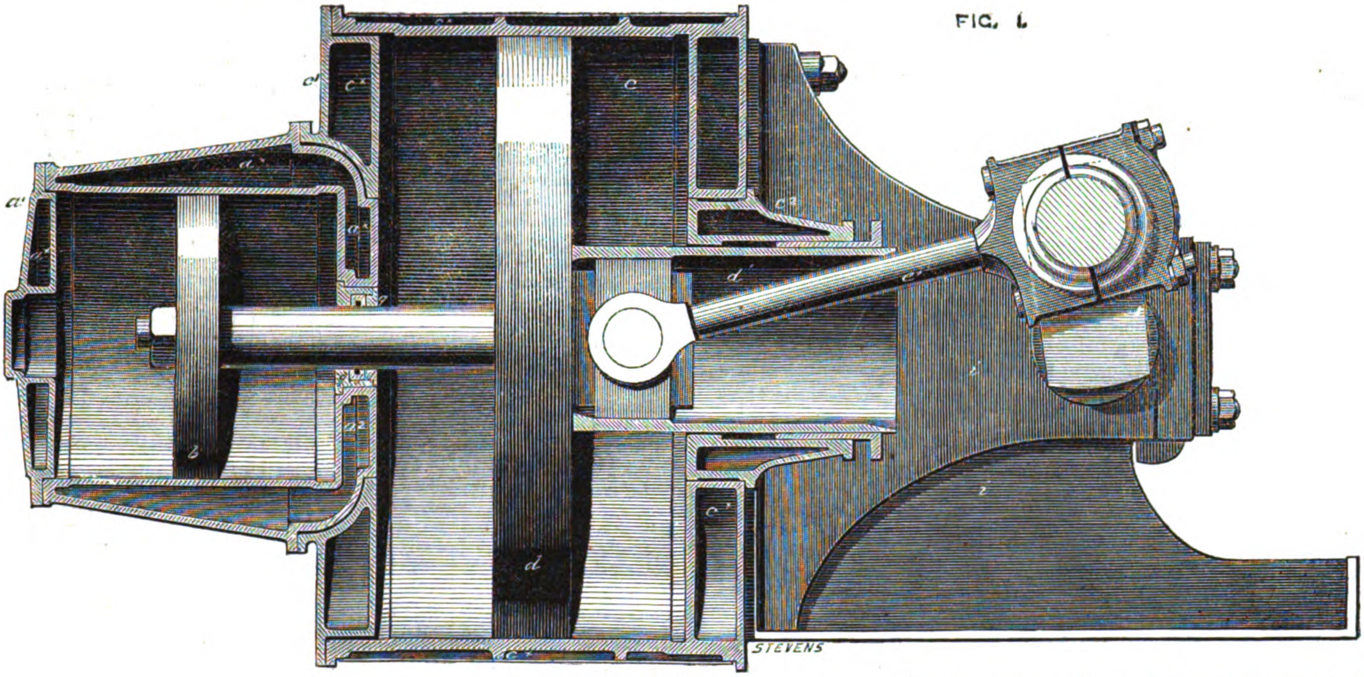
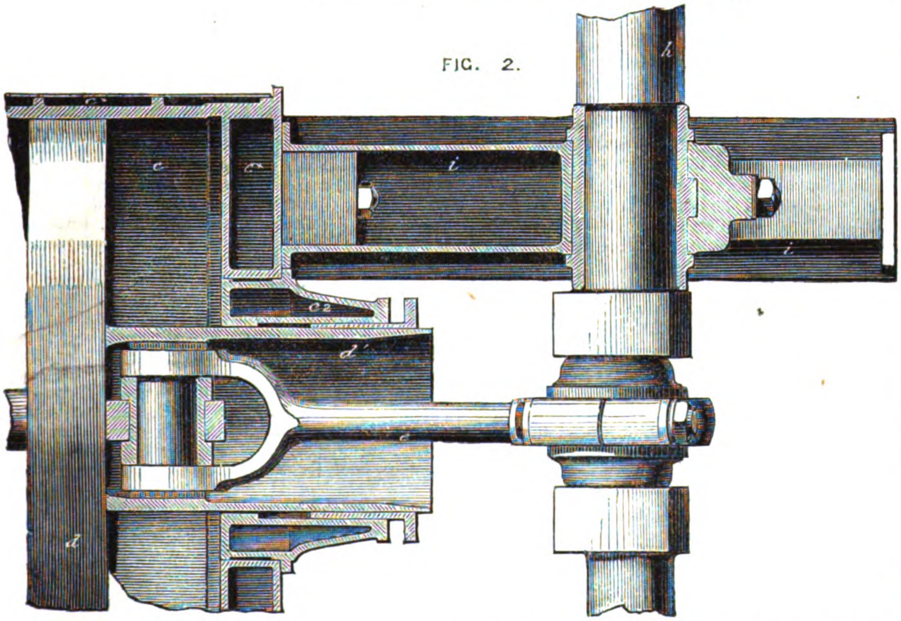


FIG. 2.



HUMPHRYS'S MARINE ENGINES.

THE following is a description of some improvements in marine engines, lately patented by Mr. Edward Humphrys, the well-known marine engineer, of Deptford, Kent. This invention has for its object improvements in steam engines, and relates to that description of steam engines in which two cylinders, a small one into which the steam first enters, and a larger one in which it is subsequently allowed to expand, are employed, and in which the pistons of the cylinders are connected together by a piston rod passing through the cover or partition which separates the small from the large cylinder. The improvements consist in applying a trunk to the large piston, and a suitable connecting rod, as in ordinary trunk engines, to transmit the power from the two pistons to a crank on a shaft or axis.

Fig. 1 is a side view, partly in section, and Fig. 2 is a plan, also partly in section, of a steam engine constructed according to this invention. *a* is the small cylinder to which the steam is first admitted, and *b* is its piston; *c* is the larger cylinder into which the steam is expanded after it has worked in the cylinder *a*, and *d* is the piston of the larger cylinder. Through the pistons *b* and *d* a piston rod passes, at one end of it the bearing is formed for the pin of the connecting rod *e*, and at the other is a nut to secure it on the further side of the smaller piston; *f* is a tube which surrounds the piston rod and keeps the two pistons at a proper distance apart; *g* is a stuffing box, by preference with metallic packing, it is formed between the two cylinders *a* and *c*, and the piston rod with the tube *f* work through it, the joint being steam-tight or nearly so. a^1 is the moveable end cover of the cylinder *a*, and c^1 and c^2 are the moveable covers of the cylinder *c*. a^x, a^x, and c^x, c^x, are steam spaces, with which it is preferred to surround the steam cylinders to prevent condensation. d^1 is a trunk formed on the piston *d*, it works steam-tight through a large stuffing box in the cover c^2, and the connecting rod *e* passes down within it. *h* is the cranked axle to which the connecting rod communicates the motion of the pistons, and *i* is a frame bolted to the end of the cylinder *c*, for supporting one of the bearings of the axle *h*, the other bearing or bearings may be carried in any convenient manner. The valves and other parts of the engine which are not shown in the drawings may be of ordinary construction.

THE ISTHMUS OF SUEZ.

FROM the latest reports, the great enterprise of cutting the Suez Canal is making satisfactory progress. This is altogether a French enterprize, and has therefore been "blown" upon by English writers, engineers, and politicians. According to some of those authorities, England is the only nation which has the right to undertake any great engineering work in any part of the world. If other nations attempt to imitate our example they are regarded as interlopers. Consequently, we are regarded by foreign countries as envious and selfish. All the hostile criticisms which have been offered in this country on the Suez Canal enterprize are supposed by foreigners to spring from poisonous motives. Had French authorities listened to our continual condemnations, they would have abandoned the enterprize long since. But they have throughout treated our opinions and judgments with something like indifference. It was optional, on our part, to have co-operated with them; but instead of doing so, we have, with Lord Palmerston at our head, adopted a scolding policy, with little effect, and with little credit to ourselves. If the latest account, as published in the *Times*, be correct, there are many predictions uttered in this country likely to prove false. Engineering science is too useful a thing in the world to be retarded or misdirected by political prejudices; and we earnestly hope that the great work which has been so persistently persevered in by the French Government will become an accomplished fact.

The correspondent of the *Times* says:—The works on the Suez Canal have undergone no interruption through the death of Said Pasha. About 20,000 men are at this moment either engaged upon the works or on their way to the isthmus, collected, as heretofore, from all parts of Egypt. To each party, as it arrives, a certain portion of the excavations is allotted, calculated upon an average of 40 cubic mètres for each man. The task is usually completed in about a month, when the men are allowed to return to their villages, generally carrying with them the trifling balance of their earnings that remains after paying the cost of the simple food upon which the Egyptian fellahs are content to live.

The efforts of the company are at present almost entirely directed to the completion of the canal, by which fresh water will be conveyed to Suez. It branches off, near Lake Timsah, from the small canal, previously dug by the company, and which, as your readers will remember, is a prolongation of the Wadi Toumilat Canal. The watercourse is about 25 ft. in width, with a depth of about 5 ft. It is already completed as far as the Bitter Lakes, and the engineers of the company expect to reach Suez before the middle of the coming summer. Their next task will be the construction of a feeding canal, starting from Cairo, and running along the edge of the desert, the execution of which, though lately abandoned, has been finally decided upon. Without it, indeed, it would be impossible to maintain a sufficient level in the new canals, even while draining their neighbours, to the grievous injury of the cultivators dependent upon the latter for the irrigation of their lands.

Having just returned from a visit to the Isthmus, I am able to speak of the impressions created by personal observation, and I confess that it is the inspection of the new fresh-water canals which seemed to me calculated to inspire the most lively interest. The sight of a stream of fresh water, flowing through the still and death-like solitude of the desert, of itself offers a most singular spectacle. A practical end can also more readily be assigned to this portion of the company's projects. To the inhabitants of Suez the acquisition of fresh water and of the attendant means of vegetation will be a boon of real value, and although new accessions of arable land are hardly yet an object of necessity to Egypt, yet the canals afford the prospect that many productive spots along their banks may yet be redeemed from the surrounding wilderness.

Between the fresh-water canal and the *rigole*, or preliminary trench of the maritime canal, runs a small channel, about 5 ft. wide and 5 ft. to 6 ft. in depth, which serves to supply the labourers with water, and which is lengthened as the work on either side progresses, being, however, always kept a short distance in advance. The cutting for the maritime *rigole*, through the ridge of the Serapeum, which, next to the Gisr, is the highest land on the course of the canal, I was informed, will for a short time remain in abeyance, while the fresh-water canal is pressed forward. The cutting of El Gisr has been dug to a depth, at its highest levels, of about 70 ft., and it forms a channel containing a width of about 25 ft., and a depth of 4 to 5 ft. The trench is cut, as elsewhere in the desert, with its sides at an inclination of 2 ft. for every 1 ft. in depth. The ridge terminates towards the north in a plain covered with hillocks of light sand, which, about four and a-half miles further on, sinks below the level of the sea, and is now covered with a shallow sheet of water, communicating with lake Menzaleh. It is along these four to five miles of the line that the canal appears to be exposed to the greatest danger from land-drifts. But it is maintained that the embankments which will be formed when the canal is excavated to its full width and depth will afford ample protection. As a further precaution, hedges of cane and brushwood are put up at various points across the plain. These, it is contended, will serve as barriers against the progress of the heavier particles of sand, which being raised by even the most violent storms at but a slight elevation, and moving at a low velocity, are brought to the ground on meeting with the least obstacle. The lighter particles, being lifted high into the air, are carried away over long distances, and on again falling to the ground are spread so lightly over the plain that it is contended they can be of little or no practical effect.

The track of the canal along the greater part of its course through Lake Menzaleh is clearly marked by the embankments, of which the bases have been raised on either side at a distance of 60 metres across. Two small channels have been formed, one on either side, with a depth of water just sufficient to give passage to a small boat. The central portion of the canal is still untouched, and the mud which forms the bed of the lake frequently shows itself above the surface of the water. The embankments are made of this same mud, which was lifted by hand labour from the bed of the lake. Near Port Said the traces of the embankment become very slight, and in some places our boat seemed to cross the open lake. The work is to be continued by means of dredging machines. The mud is raised in almost a liquid state, and is poured into a species of caisson formed of planks, supported by wooden piles driven into the bed of the lake. On rising above the level of the water, the mud hardens into a solid mass. This portion of the work, as will be readily believed, has been attended with great difficulties and trouble, but the worst is believed by the engineers to be past.

As the canal approaches Port Said it is to attain the width of 80 mètres, terminating in a basin or dock of 800 mètres square. This basin is likewise to be deepened by means of dredging machines. As yet only 16 machines have been put together at Port Said and along the canal, but I was informed that the number will shortly be raised to 50, and that each is expected to excavate an average of little, if at all less than, 1,000 cubic mètres a day.

The channel of communication with the sea will be 400 mètres wide, and its entrance is to be protected by a double jetty. The western mole is to be prolonged to a distance of 3,400 mètres, or somewhat more than two miles, where it will reach a depth of water of 10 mètres, or about 32 feet.

A small islet of stone has been formed at about half the distance as a nucleus to the future pier, and to serve for the discharge of the boats that come to Port Said with stone and other materials and stores. The temporary wooden jetty is about 200 yards in length, and is partially filled in with stone. The accumulation of sand that has been formed on the western side advances the beach to the extent of about 50 yards into the sea; but the engineers are disposed to attach but little importance to the matter. They argue that before the sand can reach the extremity of the mole, it must fill up an angle formed by a basis extending to an almost unlimited length along the coast to the westward, and of an elevation of upwards of two miles. The stone required for the works at Port Said has hitherto been brought at an exceedingly heavy cost from the quarry of El Meks, near Alexandria. Future supplies are to be drawn from the hills of Gennefieh, near the Bitter Lakes, and to be brought in flat-bottoned boats along the canal, at the estimated cost of 14f. the cubic mètre.

At Suez, it will be remembered, the intention of constructing jetties has been abandoned, and it is proposed simply to deepen the channel that leads from the anchorage to the town, a distance of about four and a half miles, and which is practicable for small boats alone. The channel is formed on its western side by a large sandbank, partially uncovered at low tide. At its further extremity the Messageries Imperiales have commenced the foundations of the dry dock, in accordance with their contract with the Egyptian Government. The dock will be connected with the shore by an embankment 2½ miles in length, already in course of construction, over the sandbank, and which will be surmounted by a railway. It strikes one as a singular thing, considering the implicit confidence with which the success of the Canal Company appears throughout to have been regarded by the French public of all classes, as well as by the late Viceroy, that it should not have been resolved to await the conclusion of the improved channel, when the dry dock might be constructed close in shore on a far more convenient spot, and, of course, at a very much lighter cost.

AXLE BEARINGS.

MR. N. J. AMIES, of Manchester, has lately patented a composition to be used for the bearings for carriage and other axles. It consists of animal fibre, plumbago, steatite, caoutchouc, or gutta percha, and any resinous gum or animal glue or size, the proportions being almost immaterial if the animal fibre be in sufficient excess; the composition being moulded or cut into the regular form.

Vegetable fibres have been similarly used before; but inasmuch as animal fibres, such as silk, wool, hair, or disintegrated skin or pelt are much more durable, and possess other superior qualities, the patentee employs it in combination with the aforesaid materials in contradistinction to vegetable fibres, as not having been hitherto so employed. In bearings, journals, or other frictional surfaces where water may be employed to assist in lubrication, he prefers to employ a resin or gum called "rhus copallinus" (gum copal), or a varnish made therefrom, as the medium to unite or bind together the other components, as such gum will best resist water in a heated state. The bearings, bushes, journals, steps, and other frictional surfaces are to be cast or otherwise produced with cavities, spaces, or excavations for the reception of the composition or filling, which is placed next to and in immediate contact with the shaft or wearing surface; or, if required, the composition may, in some instances, be used solid, without the support or combination of metal or wood. The composition will be found suitable for such purposes composed of silk, wool, hair, or other animal fibre (either in a fibrous state or reduced to a pulp), two parts; plumbago, steatite, or similar lubricating or antifrictional material, half a part; and resinous substance, gum, or varnish, half a part; or in such other proportions as circumstances may require.

ARTILLERY EXPERIMENTS AT SHOEBURYNESS.

A SERIES of interesting experiments with Whitworth, Armstrong, and Lynall Thomas guns against various thicknesses of armour plates, were tried on Tuesday at Shoeburyness. The experiments were conducted by Capitain Alderson, R.A., under the command of Colonel Taylor, R.A., and the guns were aimed by Lieutenant Reeves, R.A.

The target was altogether stronger and made of finer iron than any yet experimented upon. The plates were of the best rolled iron which could be made by a manufacturer of such eminence as Mr. Brown, and it was universally admitted that in the quality of the iron and method of working they could not be surpassed. They were of three different thicknesses upon the target, the upper plate being 5½ inches thick, the middle one 7½, and the lowest 6½ inches. The target was about 12 feet square, and for about half of its breadth the plates were backed with teak planking, varying in thickness slightly from 9 to 6½ inches behind the thickest plate, so as to allow the face of the target to be plane. The other half of the target was left entirely without backing, in order to test the value of this timber support, which it will be remembered is in the "Warrior" and "Achilles" 18 in. thick, and in the "Minotaur" only nine. The plates were bolted on to the skin by 2-inch bolts, fastened with screw-nuts, the large heads of which were in this instance protected from the great concussion by three washers of gutta percha and one of lead. The skin was of the usual thickness, ½-inch, behind the thinner plates, but it was made 2 in. thick to support the heavy 7½-inch armour plate. Besides all this came very strong ribs and transverse bracings of wrought iron, with an immense crosspiece running the whole breadth of the target, which we could not describe better than by the name of the manger, which it got before the day was out. There was no chamber behind this target, as in that which the Whitworth shell penetrated, but it was merely shored up by enormous balks of timber, to which it was braced, and which transferred their burden to the bank of earth behind. It will be seen, then, that this target was altogether as strong as iron could make it in anything like a ship's side; but as to the wood backing, it was weaker by half than the other targets experimented upon, and than the "Warrior."

The range at which all the guns were fired was 200 yards. The practice commenced with shots fired to try the plates, and ascertain the comparative effect of 68-pound shot and the same weight of shot sent from a rifled gun. In this way three shots from the 68-pounder service gun with 16 lb. of powder were fired, producing the usual dents in the plates. The three shots which followed, and produced precisely the same effect, were fired from Sir W. Armstrong's 110-pounder service gun with oblong steel shot, as proposed by Ordnance Select Committee, the charge being 16 lb. of powder. The next shot was from the Armstrong 300-pounder muzzle-loader rifled gun, weighing 12 tons, with a solid steel shot of 300 lb. and a charge 45 lb. of powder. This struck the middle and thickest plate right in the centre, and almost in the bull's-eye, producing a large dent of three inches in depth, and slightly cracking a rib behind. The velocity, as given by Navez's ballistic apparatus, was 1,290 ft. per second. The same gun was next fired with a 300lb. steel shell, containing a bursting charge of 11lb. It struck the 5½-inch plate at the left-hand corner, pierced it, and burst in the wood backing, cracking the skin, and breaking three or four strong ribs, besides knocking the heads off some rivets and breaking off one bolt. The wood was set on fire also. No part of the shell, however, had come through into the ship, so to speak, neither were there many pieces of the skin scattered about; the general shaking of the whole mass, however, was evidently considerable, and quite enough to settle the fate of the "Minotaur" in the face of such a weapon. The velocity of this shot was given as 1,310 ft. per second. The Whitworth gun was now tried with a 148 lb. shell of the description used in former experiments in November last, with a charge of 25 lb.; it penetrated the 5½-inch plate about 4 in. to the right of the hole made by the Armstrong shell, and burst in the wood, but without getting through the skin. The noticeable point in this experiment was that the smaller and lighter gun, with half the weight of shot and powder, did almost an equal amount of mischief. The bursting charge of this shell was 5¼ lb. It was this gun which sent its shell through the 5-inch plate and timber backing at 600 yards' range.

Mr. Lynall Thomas's monster gun was now to be tried. On the whole its accuracy was very good, and we heard no reason given for the one shot which missed the target. This gun weighs 17 tons, and is a muzzle loader rifled, and of nine-inch bore. After two scaling charges of 50 lb. of powder, a 320 lb. shot was fired; it struck the ground at the left-hand corner of the target, carried away part of the bank behind, and, amid a storm of earth, flew with a loud roar away to seaward. The gun was loaded again with a solid projectile, 18 in. long, having three spiral grooves on it to fit corresponding fillets in the bore, and weighing 370 lb., with a charge of 50 lb. of powder. This time the target was hit at the junction of the 7½ and 6½ in. plates, a large dent of 3½ in. deep was made, and the plates were considerably cracked, but nothing went through. The shot rebounded about 25 yards, and when fished out of the ditch was found to be "set-up" several inches, so that it looked like a huge cauliflower, the stalk being the end which did not strike the target. The velocity of this shot was given as 1,300 feet per second.

A solid tempered steel shot of 328 lb. was then fired from this gun with a 50 lb. charge; it penetrated the 7½-in. plate to the wood, just at its lower border, and grazed the 6½-in. plate; the plate was cracked, as well as the skin, a bolt was broken, and the manger was knocked completely off on to the ground. The velocity of this shot was given as 1,250 feet per second.

The last shot was from Sir William Armstrong's rifled shot gun, with a 150 lb. spherical smooth shot, with a 45 lb. charge. This struck the 7½-in. plate where there was no backing, cracking it widely, starting the bolts, and penetrating to 3½ in. It shook the whole structure severely, and bulged the plate extensively, but did not get through the plate. The general opinion seemed to be that the target had been subjected to so much pounding that the later experiments were not worth much, and that it would have been much more satisfactory if Sir William Armstrong's heavy shell had been fired at the thickest, instead of the thinnest plate. Another point appeared to be that no thickness of armour a ship could carry would be proof against these heavy steel shot. The experiments excited the greatest interest, and the day being beautifully fine there was a large gathering of scientific artillerists.

TO CORRESPONDENTS.

Received.—C. C.—Capt. N.—G. C.—G. B.—D. H.—C. B. A.—N. B.—Mac. A.—Bross and Co.—D. and S.—G. N. D.—W. P.—W. R. T.—T. R.—S. S.—W. and Co.

T. G.—The letter is much too personal, verbose, and insulting for our pages. The first letter has not been received.

L. M.—Thanks.

Tyro (Huddersfield).—The total steam power in England was estimated by Dr. Fairbairn as equal to that of 8,000,000 horses, besides 3,000,000 horse power afloat.

F. S.—"Truran on the Iron Manufactures of Great Britain" is the best work on the subject.

D. H.—You will find that a number of patents have been taken out for hydraulic cranes, &c., both before and after 1846, the date of (Sir) W. G. Armstrong's patent (No. 11,319). T. Crowther, in 1852 (No. 14,340), took out a patent for a self-acting crane. See No. 1888, year 1855; No. 812, year 1856; also No. 967, year 1856 (taken out by Sir W. G. Armstrong). See also No. 1768, and No. 2,356, year 1858; also No. 644, year 1859. A more prolonged search would probably reveal to you several more patents of this description.

F. P.—By applying personally and carrying good testimonials with you, you may succeed; good interest, however, is better than the highest merit in this case.

T. S. (Ipswich).—The angle formed by the sides of Mr. Whitworth's standard V threaded screws is 55 deg.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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MR. REED AND CIVILIAN.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Having for many years taken great interest in all matters relating to the British Navy, and having attentively read the able articles and letters which have from time to time appeared in your valuable paper having reference thereto, I shall be glad if you will give insertion to a few words from me on Mr. Reed's ships, and your correspondent "Civilian's" remarks thereon. It appears to me, as of course it must to every one of your numerous and intelligent readers, that the only object we have in view is to arrive at the truth in this all-important question of iron-plated ships. Now, from the general tone of "Civilian's" letters, I gather that he is, from some cause or other, of which, of course, I am ignorant, rather opposed personally to Mr. Reed than to the principle upon which that gentleman's ships are being constructed. It is, I think, impossible for any impartial person to read "Civilian's" letter on the new Chief Constructor of the Navy, in your impression of the 27th ult., without coming to this conclusion. He there endeavours to show how probable it is that Mr. Reed knows next to nothing of the theory and practice of shipbuilding, and speaks of "a Watt, a Lang, a Turner," and "a Moody," as though they were the Cæsars or Alexanders of the profession. I would also remark that such phrases as the "Reed scheme," "the fighting box," and the "new born chief," when used in the manner in which "Civilian" uses them, appear to me to show the animus of the writer, and, to say the least, are not indicative of impartial controversy. When "Civilian" does touch upon the *demerits* of Mr. Reed's ships (of course they have no merits), he seems to think he has proved an important point when he has shown that the "Enterprise," a ship of about 900 tons burthen, is not so strong inch for inch, and does not carry in proportion so great a weight of armour as the "Warrior;" but surely everybody knew this before; and the suggestion of "Civilian" to submit the "Enterprise" to a target trial is simply absurd. We all know pretty nearly what amount of battering her sides will stand, and we know also that the simple production of a target to keep out shot and shell is not the only desideratum in a sea-going ship of war. If Mr. Reed has given us a ship of less than 1,000 tons burthen, plated from stem to stern in the region of the water line with 4½-inch armour plating, and capable of carrying amidships four 110-pounder armour-protected rifled guns having a nearly fore and aft range of fire, rigged as an ordinary ship of war, and capable of bearing the flag of Old England to the antipodes; I say, if Mr. Reed has given us this ship—and of this there appears to be little, if any doubt—he has given us what we had not got before, but what we certainly wanted. I was glad to find your able and impartial correspondent, Mr. Cheverton, dealt with this subject in your number of the 6th inst.; he undoubtedly discusses the matter fairly, honestly bringing forward both sides of the case, and he has done much to develop the truth.

I do not believe in any conspiracy on the part of the Admiralty to waste the public money by building wooden ships. They are feeling their way cautiously and prudently; and I have no doubt that, if it be finally demonstrated that wood is in every way inferior to iron for the construction of ships of war, they will discontinue building ships of wood, and resort entirely to iron. One thing, however, is certain, viz., that scientific problems cannot be solved by fierce partisanship and one-sided reasoning.

I am, &c.,
Observer.

PATENT LAW REFORM.

Sir,—I beg leave, before I lay my scheme of *Patent Law Reform* before your readers, to make some additional remarks. There is, as I believe, every prospect of this subject being substantially investigated by the Commission, and considerable alterations in the Patent Laws are anticipated. How far Parliament may be disposed to adopt the Commissioners' Report is, at least, questionable, and I allude to this as a check to sanguine expectations on the part of inventors. The subject is, as I have before observed, a difficult one, involving cross interests—those of the public on the one hand, and those of inventors on the other hand.

It is my intention to devote this letter to one point. The point I refer to is this—*i. e., the questionable validity of a patent.* All patents are questionable on the two following grounds, viz.:—

1. The *novelty* of the invention.
2. The *validity* of the patent itself.

1. *The novelty of the invention.*—By the present law this is left an open question. A patentee, or his assignee, may manufacture for several years without opposition, and presently may be surprised with an "infringement." In other cases, a patentee, or his assignee, manufactures under the supposed validity of his patent amidst a constant "storm of opposition." What is to be done to remedy this state of things? The best suggestion I can make is to exercise greater caution before making application for a patent. The remedy for this mischief is, to a great extent, at least, in the hands of the applicant, and this cannot, as I think, be too well understood by patentees.

2. *The validity of the patent itself.*—This branch of the subject will, I trust, receive careful and thoughtful consideration by the Commissioners. It is a hard case to have a patent upset on the ground of validity—that is, the invention being one for which a patent will not lie. The subtleties of the celebrated "Statute of Monopolies" still pervade our system of patent law—this Act being, in fact, the basis of such system. A case illustrative of this "hardship," for such it really is, is now pending in the Court of Chancery, being an injunction suit. It is surely contrary to *moral principle* that the fees should be taken upon an instrument which may turn out, when "put in suit," to be valueless. This is a branch of the subject to which I beg leave to call attention, and which it is desirable to devise a remedy.

In conclusion, sir, let me mention that the sense of my last letter is much embarrassed by some verbal inaccuracies. The blame, to some extent, is, I must acknowledge, with myself for indistinctness in penmanship. With your permission I will lay my scheme before your readers in my next letter, and I propose to do so with as much simplicity as practicable.

I am, &c.,
T. Culverhouse.

3, Compton-street, Ball's-pond,
March 10, 1863.

STEAM PLOUGHING.

Sir,—In your article on the "Great Steam Plough Trial," Mr. Bovill, the leading counsel on the plaintiffs' side, is reported to have said, "When the patent of Messrs. Fiskin was taken out, the problem of ploughing by steam was solved, and the first approach was made to the construction of a really useful and serviceable steam-plough." You add these words—"To this we fully agree." Then let me call your attention to the 19th March, 1855, the date of my steam-plough patent. Hundreds of these ploughs are now in useful and serviceable operation, and my own farm has been regularly worked by it ever since December, 1855. The Messrs, Fisken's patent is dated July 19, 1855, just four months behind mine. Now I shall not go into the question as to whether my plough that turns at the land's end is to die out to make room for the double action one of the Messrs. Fiskin; but I shall and do claim the honour of having been the first to solve the problem, and stand here before you as king upon the question of steam-ploughing. Yes, and if I may be permitted to live a few years longer, I shall see the double action thing a dead letter, for a thing that can live only by working its engine at double its nominal power must die. England stands first and claims the honours.

I am, &c.,
William Smith.

Woolston, Bletchley Station, Bucks,
March 16, 1863.

P.S.—The balance principle depends more upon the clip drum than it does upon itself, for all other modes of application have already failed.

Meetings for the Week.

Mon.—*British Architects*, at 8 p.m.
Medical, at 8.30 p.m.
Royal Geographical Soc.—I. "Kurrachee to Gwadur, on the Mekram Coast, in the Cold Season of 1861-62," by Major F. J. Goldsmid, F.R.G.S. II. "On the Harbour of Ledashagur, by Dr. D. Macpherson, at 8.30 p.m.
London Inst.—"On Music," by Josiah Pittman, Esq., at 7 p.m.

Tues.—*Inst. Civil Engineers.*—I. "Description of the Lydgate and of the Buckhorn Weston Railway Tunnels," by J. G. Fraser, Esq. II. "The Public Works in the Province of Pernambuco, Brazil," by W. M. Peniston, Esq., at 8 p.m.
Royal Inst.—"On Animal Mechanics," by Prof. Marshall, at 3 p.m.

Wed.—*Soc. of Arts.*—"On the Present Sources of Supply of Quinine, with Special Reference to the Introduction of the Chinchona Plant into India and other Countries," by C. R. Markham, Esq., at 8 p.m.
London Inst.—"On the Zoology of the Warm-blooded Vertebrata," by C. C. Blake, Esq., at 7 p.m.

Thur.—*Royal Inst.*—"On Chemical Affinity," by Dr. E. Frankland, at 3 p.m.
Inst. of Naval Architects.—"On the Naval Architecture of the Exhibition of 1862," by Vice-Admiral Paris, C.B. "On the Construction of Iron-plated Ships," by W. Fairhairn, Esq. "On Iron-plated Ships," by J. D'A. Samuda, Esq. "On Modern Guns and Iron-coated Ships," by J. Scott Russell, Esq., at 12 a.m.—Evening Meeting: "On the Steering of Ships," by N. Barnaby, Esq. "On Copper and other Sheathing for the Navy," by W. J. Hay, Esq., at 7 p.m.
Numismatic, at 7 p.m.
Antiquaries, at 8.30 p.m.
Royal Soc., at 8.30 p.m.

Fri. — *London Inst.*—"On Economic Botany," by R. Bentley, Esq., at 7 p.m.
Inst. of Naval Architects.—"Experiments with a Rotating Ship Clinometer," by Prof. C. P. Smyth, F.R.S. "On the Rolling of Ships," by J. Scott Russell, Esq. "On the Resistance of the Medium as Limiting the Angles of Rolling," by W. Froude, Esq. "On Isochronism of Oscillation in Floating Bodies," by W. Froude, Esq. "On Iron-clad Sea-going Shield Ships," by Capt. Cowper P. Coles, R.N., at 12 a.m.—Evening Meeting: "On Iron and other Masts and Spars," by C. Lamport, Esq. "On Framing Iron Bulkheads," by G. C. Mackrow, Esq. "On the Protection of Iron from Oxidation and Fouling," by W. J. Hay, Esq., at 7 p.m.
Royal Inst.—"On Phallium," by W. Crookes, Esq., at 8 p.m.
Architectural Association.—Class of Design. Chalice, Flagons, and Paten.
Philological, at 8 p.m.

Sat. —*Inst. of Naval Architects.*—"On the Education of Naval Architects in England and France," by J. Scott Russell, Esq. "On H.M. Yacht 'Fairy,'" by T. J. Ditchburn, Esq. "On Measuring the Strain on Ship's Cables," by T. M. Gladstone, Esq. "Differential Wave in a Stratified Fluid, with an Experimental Illustration," by W. Froude, Esq., at 12 a.m.
Royal Inst.—"The Science of Language," by Prof. Max Müller, at 3 p.m.

Gossip.

On Saturday, the 14th inst., the London Association of Foremen Engineers celebrated their tenth anniversary by a dinner at the Bay Tree Tavern, City. Mr. W. H. Keyte presided. The dinner was as usual—excellent. The loyal toasts were given, and able speeches were delivered. The principal event of the evening, however, was the presentation of a testimonial to Mr. Joseph Newton, of the Mint, in recognition of his services to the Institution during the four years he has been President. The testimonial consisted of several articles of plate, including a salver, an inkstand, and a card tray. They bore the motto, "Reap as you merit." The inscription engraved on the salver was: "To Joseph Newton, President of the London Association of Foremen Engineers. This testimonial is presented as a token of esteem, 14th March, 1863." Mr. Newton expressed his thanks in a suitable speech. We are glad to learn that the Association is in a most flourishing condition.

Her Majesty's steam sloop "Spiteful," Commander Wilson, from the West Indies, was paid off at Woolwich on Saturday. When at Havannah her crew were attacked by yellow fever, of which no less than fifty men, including six officers, died. On the voyage home; a man who fell overboard was saved by Clifford's lowering gear. The poor fellow was unable to swim, and had already disappeared, when the boat was manned and lowered, and in three minutes the drowning man was in the boat, safe. This is another instance of the rapidity by which a boat may be lowered by this invention, and is due to the fact of the entire control of everything resting with one man, and not being the result of the divided duty of several, as in lowering by the falls.

The ordinary meetings of the Institution of Naval Architects for 1863 will be held at the Society of Arts on Thursday, Friday, and Saturday next. Sir John Pakington will take the chair. Papers of considerable interest will be read by Vice-Admiral Paris, of the French Navy; Dr. Fairbairn, Mr. Scott Russell, Captain Cowper Coles, Mr. W. Froude, Professor C. P. Smith, Mr. N. Barnaby, Mr. J. W. Hay, Mr. G. C. Mackrow, Mr. T. M. Gladstone, and others.

Mr. Alderman Waterlow has commenced a work worth imitating in Finsbury. He has just finished a block of improved buildings for the working classes. These buildings are substantial; and each family compartment contains the conveniences requisite for a working man's home. The great want of London and other cities is better house accommodation for the mass of the people. Model lodging-house schemes have not been attended with success—partly, we believe, because they have carried with them too much of the philanthropic element, and too little of the economical element. There is no reason why good, substantial, well-ventilated dwellings may not be provided at a cheap rate; and great credit is due to Mr. Waterlow for the useful enterprise he has commenced.

At the Mersey Dock Board on Thursday, on a question of substituting "cradles" for "blocks" in repairing ships, it was said that the very act of repairing them by the latter method was the means of putting them out of repair. Blocks force the ships' caulking so much that they are frequently found to be leaky after undergoing a thorough repair.

The Scotsman says that at Limekilns, Fifeshire. on the 10th inst., some persons were desirous of showing their loyalty by firing a salute, but a serious obstacle presented itself, in the fact that no such thing as a piece of artillery existed in the place. A local genius set to work, however, and in a short time had fabricated a cannon out of ropes which he coiled tightly in the shape of a tube. The experiment was highly saccessful, the salute being fired without accident.

The lighthouse recently erected at Allepey, in Travancore, India, on the coast of Malabar, is distinctly visible from the Ghaut mountains at the great distance of 54 statue miles. It is a holophatal revolving white light. The lenticular portion of the apparatus was made by Messrs. Chance, of Birmingham, and the lantern and machinery were made by Messrs. Milne, of Edinburgh, all from designs by Messrs. Stevenson, civil engineers.

Application has been made to Parliament for power to construct a footway bridge over the river near the Tower. We understand that, in consequence of the opposition of the wharf owners to the bridge, from its interference with the navigation, the engineer, Mr. Barlow, has proposed for the same estimate to construct an iron subway or tunnel under the bed of the river at the same spot.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2324, 2337, 2338, 2343, 2353, 2358.
Boilers and Furnaces, 2317, 2321.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2325, 2344, 2354.
Ships and Boats, including their fittings, 2316, 2345, 2352,
Cultivation of the Soil, including agricultural implements and machines, 2312, 2364.
Food and Beverages, including apparatus for preparing food for men and animals, 2320, 2360.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2308, 2314, 2318, 2323, 2331, 2335, 2350, 2355, 2365.
Buildings and Building Materials, 2362.
Lighting, Heating, and Ventilating, 2311, 2313, 2315, 2341.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2309, 2319, 2328, 2332, 2340, 2342, 2347, 2363.
Metals, including apparatus for their manufacture, 2336.
Chemistry and Photography, 2330.
Electrical Apparatus, 2334.
Warfare, 2310, 2349, 2351.
Letter-Press Printing—*none*.
Miscellaneous, 2307, 2322, 2326, 2327, 2329, 2333, 2339 2346, 2348, 2356, 2357, 2359, 2361.

2307. H. Garside. *Improvements in machinery or apparatus for marking, etching, or engraving on cylindrical and other surfaces.* Dated August 16, 1862.

This invention consists—1, In the employment for marking, etching, or engraving upon cylindrical surfaces of two frames used in connection with a pentographic arrangement, from which pentographic arrangement motion is imparted to the said frames by means of two slots, bars, grooves, or slides, one of which is attached to each frame, and which said slots, bars, grooves, or slides cross each other at right angles, and receive motion from the pentographic arrangement at their point of crossing over or intersection with each other. One of these frames carries or communicates motion to the marking, etching, or engraving points or tools, in a direction parallel with the axis of the cylinder operated upon, and the other frame moving at right angles to the foregoing, imparts all of such rotary movements to the cylinder as may be necessary in combination with the straight line movement of the marking, etching, or engraving points or tools to produce upon the cylinder the figures desired. 2, In the employment for marking, etching, or engraving upon cylindrical or other surfaces of two frames or tables, carried by or moving upon wheels or rollers, and actuated by a pentographic arrangement. The lower of the two frames or tables is constructed to move in a direction at right angles to the axis of the cylinder operated upon; and the second table which rests upon, and is carried by the first, and partakes of its movement, is capable of being moved thereon in directions parallel with the axis of the cylinder. 3, In the employment for engraving machines for cylinders of a castor for supporting the arm of the pentographic instrument which carries the traction point, in lieu of the suspension cord, over head pulley, and balance weight hitherto used. 4, In the employment for engraving on flat or irregularly formed surfaces of a system of tools, actuated by means of voltaic electricity in combination with electric magnets attached to, or connected with, such tools. 5, In the employment of magneto-electricity for the generation of force to be used in actuating or withdrawing the tools or instruments employed for marking, etching, or engraving on cylindrical or any other-formed surfaces, such force having been hitherto generated by means of voltaic electricity. *Patent completed.*

2308. C. H. J. W. M. Liebmann. *Improvements in machinery for finishing textile fabrics.* Dated August 16, 1862.

This invention relates, chiefly, to machinery employed in producing what is technically known as the whirlpool finish upon textile fabrics, and for which letters patent were obtained by Isaac Beardsall, dated Dec. 12, 1855 (No. 2807); also for similar machinery by Charles Weiss and Henry Lister, dated March 20, 1857 (No. 781). The action or operation of this machinery upon the fabrics is intermittent, or by intervals of time for action and for moving the fabric forward in the machine, and these changes have to be effected by hand. Now these improvements consist in combining, arranging, and applying apparatus or parts to effect these changes by mechanical means at suitable intervals. For these purposes worm are fixed in the upright shafts which operate the tables gearing with wheels in which are stud pins, to which are attached rods connecting to the table, so that at each revolution of the wheels the table will be lifted and lowered. Another stud in one of the worm wheels operates a lever to put in or out of motion the rollers which carry the fabric through the machine, so that when the table is raised motion will be given to the fabric, but when the table is lowered the fabric will be at rest. Also a catch and notch plate are applied and geared in such a manner that one revolution thereof will cause the fabric to move forwards the width of the table at the proper distance required. These improvements are also applicable to machinery employed in the finishing of Witney cloth, and in machinery for napping and frizzing textile fabrics. *Patent abandoned.*

2309. T. Knowles and W. Robinson. *Improvements in racks for window blinds.* Dated August 16, 1862.

In order to adjust the cord of the window blind to the requisite place and tightness, the inventors introduce an endless elastic band, made of vulcanized india-rubber, or other suitable material, the said elastic band passing over the ordinary roller knob and a stud sliding in the groove of the rack in the usual manner, so that, when the knob and stud are adjusted to the proper place or position, according to the length of the cord, the said elastic medium connecting the knob and stud gives an additional spring or elasticity to allow of knots, snarls, or other irregularities that may occur in the cords. They use the said elastic endless band either inside or outside the rack, as may be found most desirable. *Patent abandoned.*

2310. M. Iturriaga. *Improvements in fire-arms.* Dated August 16, 1862.

This invention consists of certain improvements in connection with fire-arms, whereby a great number of shots may be simultaneously and consecutively discharged from one arm, the arm itself being fastened around the body of the soldier, and concealed, if desired, by a coat or cloak. The arm is constructed as follows:—A segmental or semicircular bar of iron or steel of a square section is pierced or bored at its periphery in four or other number of rows, so as to form a number of barrels, on the same principle as the revolving chamber of a repeating pistol, the breeches of all the barrels in each separate longitudinal row communicating with each other by the medium of a channel or groove. The interior periphery of the segmental series of barrels is provided at or about the centre thereof with four or other number of nipples, according to the number of rows of barrels, set obliquely under each other, one nipple serving for the discharge of one entire segmental row of barrels. This segmental or simicircular series of chambers is then to be fixed in a metalic belt by means of slots or grooves cut obliquely vertical therein, and into which corresponding projections on the segment slide, so as to hold the series of barrels firmly thereto. Either the right or left side of the belt is provided with a lock, and a handle or trigger, which actuates the main spring, and raises the hammer simultaneously, and discharges the same upon the uppermost nipple of the series; after renewing the motion of the handle a lever acts upon projecting studs behind the segment, and slightly raises the same obliquely upwards in the belt bringing the next nipple underneath the hammer, which is, consequently, discharged, exploding the second series or row of chambers in like manner to the first; so also the third and fourth or other number of rows may be discharged. The arm may be made in two semicircular divisions, so as to form a ring completely encircling the body of the soldier, and enabling him to discharge projectiles in every direction around him. *Patent abandoned.*

2311. S. A. Bell and T. Higgins. *Improved apparatus for dipping lucifer matches.* Dated August 16, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2312. G. Chapman. *Improvements in reaping machines.* Dated August 18, 1862,

This invention relates to the arrangement and construction of a mechanical movement for effecting the removal of the cut crop from the platform of the reaping machine, and depositing it at the side of the machine. Under one modification, or system of arrangement, a square pillar, or standard, is fitted to a convenient part of the reaping machine, and in the rear of the cutter. This pillar is fitted with a slide, which traverses freely up and down it. This slide is fitted with a laterally-projecting stud, on which is carried the lower end of the lever that extends upwards above the main pillar, and is then bent at right angles, so as to extend over the platform. To the free extremity of the overhanging lever is attached a pendent rod, carrying at its lower end a rake, or flat blade. Motion is communicated to the overhanging lever from any convenient moving part of the machine which is suitable for driving a crank, or other equivalent therefor. On the stud, or axle, carrying the crank is a pendent lever, which has a bend formed in it at about one-third of its length from the stud, or axle, on which it is centred. At this part an eye is formed in the overhanging lever, and through this eye the bent part of the lever passes, which serves as the connection of the two parts. To the lower end of the pendent lever is fixed a laterally-projecting rod, which has a link at its outer extremity that encircles the rod carrying the rake. With this arrangement, when the crank is put in motion, the pendent lever moves the rake laterally in a horizontal direction to a certain extent, which is limited by the position of the bend. After reaching the extent of its traverse in a lateral direction, the bent part of the lever acts as a fulcrum by which the overhanging lever is raised, carrying with it the rake which moves in a curved direction across the platform, and descends on the other side to the point from whence it started. Thus the motion of the crank and the pendent lever causes the main overhanging lever to rise and fall, and at the same time traverses in a lateral direction, the slide on the pillar admitting of the vertical motion, and the pendent lever regulating the lateral movement. These eccentric or compound movements cause the rake to traverse in an elliptical path, so as to sweep off the grain from the platform. The rake then rises out of the way as another portion of the crop is being cut, descends on the other side, and again clears the platform, and so on continuously. *Patent abandoned.*

2313. T. Barnett. *An improved lamp or lantern for street lighting and other purposes.* Dated August 18, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2314. J. Cimeg. *Improvements in depositing silver and other metals on fabrics and other materials.* Dated August 18, 1862.

The patentee states that he has discovered it is possible to mordant fabrics, and similar soft fibrous materials—as, for example, silk, leather, and paper—in such a manner as to cause the silver, gold, or platinum, to adhere firmly to their fibres, so that it will not rub or wash off. He can also, by mordanting portions of a fabric, and afterwards bringing it in contact with a suitable solution, cause the silver, or other metal, to adhere only to the mordanted portions of the fabric, and thus he can imprint on a fabric any form of pattern in firmly adherent metallic silver or metal. Many vegetable juices (more especially those which are acid to the taste, and contain simultaneously a small amount of tannin, or a matter acting like tannin upon chemical reagents, such as currants, sorbs, and other berries, apples, pears, &c.) have, more or less, the property required. For the sake of brevity and clearness, he explains the proceeding by means of a particular example. Supposing there were ten grammes of loose silk to be silvered, the first thing to be done is a complete cleaning of the matter from all foreign substances, like grease, gum, colouring matter, &c.; now the matter is to be macerated in from 50 to 60 grammes of juice of the above-mentioned fruits, which may be stewed for winter use. The required reaction takes place immediately after the immersion: it is, therefore, only necessary to see that, all parts being thoroughly wet, the washing of the matter in distilled water be perfectly done; the said reaction cannot be destroyed any more by washing. All solutions of whatever metals proper to the metallization of glass may be applied in this case, but the solution which he prefers for depositing silver is a mixture of ammonia, nitrate of silver, and Rochelle salt. *Patent completed.*

2315. J. T. Oakley. *Improvements in heating stoves employed for drying and other purposes.* Dated August 18, 1862.

In carrying out this invention it is proposed to employ the steam from any common steam boiler or steam generator, or to use the steam from the exhaust pipe of a steam engine, and by a suitable pipe or pipes to conduct it to a superheater, which it is proposed to build either within the boiler furnace, or within some portion of the boiler brickwork, with a separate furnace, or to erect the superheater and furnace separately, and by the application of fire in the furnace, or of gas suitably applied, to produce heated vapour of the temperature required, and to convey such heated vapour through suitable pipes or flues of iron, firebrick, or earthenware to the stove or stoves to be heated. *Patent completed.*

2316. W. E. Newton. *Improvements in connecting plates, sheets, or slabs of metal, or other materials, and fastening the same on to framing applicable to armour-plating for ships, vessels, or batteries, and to roofing, and other similar purposes.* (A communication.) Dated August 18, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2317. J. Briere. *A continuous, self-acting condenser, being a new system of boiler-feeding apparatus.* Dated August 18, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2318. H. Boetius. *Improvements in fire-proof materials.* Dated August 18, 1862.

This invention consists in the application of a fibrous material, known as asbestos, in combination with fire-clay or plumbago, or both, for the manufacture of fire-proof ware—such as crucibles for melting ore, steel, brass, or other homogenous metals, pots for melting glass or other fire-proof ware. *Patent abandoned.*

2319. H. Melton. *Improvements in the manufacture of hats and caps.* Dated August 18, 1862.

This invention consists in certain improvements in hats and caps, the object of which is to enable them to present two different surfaces to the weather, or in other words, to make their surfaces reversible, in order that in fine weather a cloth or woven surface may be exposed, and a water-proof material or enamelled leather surface in wet weather. The inventor proposes to form the hat or cap with a double crown and rims, one of which is to be of cloth or other woven fabric, the other to be of a water-proof material or of enamelled leather. Each of these crowns and rims are to be sewn at opposite ends of the body of the hat or cap to the extent of half the circumference, and then the two remaining halves of the crowns are to be sewn together so as to form one piece, presenting a cloth surface on one side, and a water-proof surface on the other side, which may be drawn over either of the halves of the crown and rim, which are sewn so as to expose an entire cloth surface, or an entire water-proof surface as desired. To facilitate the movement of the reversible portion of the cap, a gusset is made on each side thereof, and an elastic cord keeps the gusset closed. Through the fixed cloth surface of the crown, two or more holes may be cut for the purpose of ventilation. *Patent abandoned.*

2320. T. Wilkinson. *Improvements in machinery or apparatus for singeing pigs.* Dated August 19, 1862.

This invention consists of an iron chamber open at both ends, and having its interior longitudinally furnished on opposite sides with tubes perforated so as to emit jets of gas. Sufficient room is left in the centre of this chamber for the carcases to pass through between the gas jets on either side. Running longitudinally through the chamber, and near the top which has an arched roof, is a trap supported on uprights at either end, upon which is placed a small truck, and this is set in motion by an endless chain passing through the chamber. This chain runs through wheels at both ends. The pigs are run from the truck, and the motion which the wheels of this truck acquire in passing along the track communicate to the carcases hanging from the truck a rotary motion while passing through the chamber between the ignited gas jets, so that on issuing forth at the opposite end they are perfectly singed. The whole machinery is put in motion by a windlass which is in immediate connection with the endless chain above referred to. The gas is supplied to the jets by a single large tube on either side. *Patent abandoned.*

2321. V. F. Cleuet. *An impoved self-acting apparatus for supplying boilers with water, applicable also to the raising and to the measuring of liquids.* Dated August 19, 1862.

This apparatus consists of a hollow vessel or float immersed in liquid contained in another vessel or case, which float in alternately filling and emptying becomes in turn heavier or lighter than the liquid which surrounds it, and partakes of itself of alternative vertical motion, whereby it is placed in successive communication with the boiler and the feed supply, to transfer from one to the other the water necessary for the generation of steam. *Patent completed.*

2322. G. H. Dembinski. *A motive apparatus, and processes proper for giving to it a continuous motion and unlimited strength.* Dated August 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2323. S. Bouctier. *Improvements in flax spinning, which improvements are also applicable to spinning of tow and hemp.* Dated August 19, 1862.

This invention consists in adapting to ordinary machinery employed for spinning flax, tow, and hemp, a reservoir to contain water of any desired temperature, and in immersing and leaving therein during the spinning operation the bobbins containing the flax or other material to be spun The aforesaid reservoir is placed at the upper part of the spinning machine, and the material is drawn from the bobbins immersed therein by the spinning machinery. By these means the process is rendered considerably more healthy for the workmen, and less costly than the modes heretofore practised of treating flax, tow, and hemp during the spinning thereof. *Patent completed.*

2324. W. J. Hoyle and J. Proven. *Improvements in mechanism and arrangements for supplying lubricating matter to the cylinders of steam engines, and to the bearings and other surfaces of mechanism.* Dated August 19, 1862.

This invention consists—1, in mechanism by which lubricating matter can be supplied to cylinders of steam engines at regular intervals, by self-acting means, during the time that the steam is entering the cylinder, at one or both sides of the piston; such mechanism consisting of a pump, which draws lubricating matter from a cistern and forces it through a valve into the cylinder, or into passages leading to it. The valve is arranged so as to be acted upon by a weight or spring of sufficient force to prevent it from being opened by the suction of the exhaust in condensing steam engines. The pump is actuated by weights or springs—that is, a small weight is employed to lift the piston or plunger of the pump to draw in the oil or lubricating matter, and a large weight is employed to force the oil or lubricating matter into the cylinder, the large weight being sufficient to overcome both the small weight, friction, pressure of spring acting upon the valve, and the pressure of the steam in the cylinder or passages leading to it. The large weight is lifted by mechanism acted upon by some oscillating or reciprocating part of the engine; but when the pump is not required to act, the small weight is prevented from descending, and when the pump is in action, the duration of its action for each stroke of the piston is determined (if required) by a stop which prevents the descent of the large weight below a fixed point; or an adjustible amount of play is allowed between the pump ram and the small weighted lever which lifts it so that the length of its stroke can be varied, and thus the quantity of lubricating matter injected may be regulated. *Patent completed.*

2325. T. H. Falkiner. *Improvements in the permanent way of railways.* Dated August 19, 1862.

This invention relates to an improved mode of securing the fish-plates or other contrivances for connecting the rail ends of permanent way together, and consists in forming upon the ends of the bolts employed two screwed portions or lengths, the one being of larger diameter than the other, and the threads on each portion being in reverse directions, the one portion being a right and the other a left-hand thread. On each of these portions a nut corresponding to it is screwed—that on the inner screwed portion serving as the ordinary or tightening nut, whilst that on the outer portion, which is of less diameter, being screwed in the reverse direction, serves the combined purposes of jamming the inner nut and also of counteracting the tendency of the bolts to turn loose. *Patent completed.*

2326. J. G. Tongue. *Improvements in processes and apparatus for extracting the natural wax or fatty matters from wool, hair, or other animal or vegetable substances, containing the same, and in the application thereof to various useful purposes.* (A communication.) Dated August 20, 1862.

The wool, fats, or grease known in commerce, contain, besides the "suint," a certain quantity of fatty acids which result from the decomposition of soap used in certain manufactures, together with the small quantity of oil or grease, which is added to wool, in order the better to work it, and may be separated according to this invention, so as to obtain products of considerable value. This is accomplished by means of spirits of wine or alcohol, of a high degree of strength, or pyro-ligneous spirit, and the application of heat. The fatty matters to be treated are dissolved in either of these spirits, and a fatty or waxy substance termed "suint" is precipitated. The alcohol employed may be easily removed and restored by distillation (as described), together with the alcohol which holds the fatty acids in solution. The fatty acids may be employed alone or in combination with other fatty substances in the manufacture of soap. *Patent completed.*

2327. W. Whittle. *The manufacture of nails and spikes by improved machinery.* Dated August 20, 1862.

For the purposes of this invention, to form blanks, the rods are passed into a machine in a cold state, and a portion of the said rod of a sufficient length to form a nail or spike is cut off. It is then held firmly between a pair of dies, one of which is stationary and the other moveable, whilst the heading tool advances and forms the head. The moveable die then recedes, and allows the nail or spike blank to fall from the machine. The blanks thus formed have no points—that is to say, they are of the same size, excepting the heads, as the rods from which they are cut. The same process may be performed while the rod is in a heated state, but the patentee prefers using the rods in a cold state. The blanks thus formed are then inserted at the ends intended to be pointed into a suitably arranged furnace containing fuel in an ignited state, and urged to a white heat either by mechanical means or by the draught produced by a chimney stack. The blanks are then withdrawn by the workman, and while in a highly heated state are inserted between the dies of a forging or pointing machine, the said dies being formed to suit the taper of the points to be given to the nails or spikes. There are four dies or tools in this machine, which may be arranged to work in pairs in planes at right angles to each other—that is to say, two of them may be made to advance in opposite directions in a vertical plane, while the other two are receding in a horizontal plane, thus alternately beating or compressing the nail or spike on the two opposite sides; or there may be two moveable and two stationary dies used for the same purpose. *Patent completed.*

2328. C. Callebaut. *Improvements in sewing machines.* Dated August 20, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2329. H. Whittaker. *Improvement in healds or heddles, and in the manufacture of the same.* Dated August 20, 1862.

This invention relates to that description of heald in which are used short wires containing the eyes instead of cords or bands. The improvements consist in attaching to each of the ordinary shafts a shaft or rod which carries the short wires containing the eyes by means of a split ring passing through a hole at each end of each wire, by which arrangement the wires will yield to the action of the yarn; any of the wires can be replaced, and the wires can be separated from each other, for allowing the hand to be passed between when required. *Patent abandoned.*

2330. W. Hutchinson. *Improvements in the manufacture of ammonia and the prussiate of potash or soda, and in apparatus employed in such manufactures.* Dated August 20, 1862.

This invention consists, first, in the manufacture of ammonia and the prussiates of potash or soda from the refuse gluten and nitrogenous matters of starch and other manufactories. To obtain the ammonia the gluten or other matters are subjected to destructive distillation, in retorts made of suitable materials, with lime or soda and lime, from which the gaseous products are conducted to suitable condensers. The crude liquor thus obtained may then be purified by adding an acid, and crystallizing by filtering or re-distilling. The prussiates of potash or soda are obtained by fusing the gluten or other matters in an iron pot or retort with potash or soda. The fused mass is then lixiviated with water, filtered or decanted, and the prussiates of potash or soda are crystallized from the solution. The prussiates of soda or potash are also obtained by passing the gaseous products evolved from the gluten or other matters when subjected to destructive distillation over a mixture of charcoal and potash or soda and iron heated to redness. The charcoal is then lixiviated with water and treated as before. Secondly, the invention consists in certain improvements in the apparatus for the manufacture of ammonia and the prussiates of potash or soda from any suitable nitrogenous substances. *Patent abandoned.*

2331. J. Standish and T. Gooden. *Improvements in machinery or apparatus used in the preparation of cotton, wool, flax, or other fibrous materials to be spun.* Dated August 20, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2332. S. Wilkes. *An improved attachment for door knobs.* Dated August 20, 1862.

In carrying out this invention, the angles of the square spindle, to which the fixed knob is secured in any well-known and approved manner, are tapped so as to form a male screw. The removeable knob is also tapped so as to form a female screw to receive the tapped square spindle in the way commonly practised. The removeable knob having been screwed on to the spindle and brought up to its required position thereon, the knob and the spindle are locked or secured together in the following manner:—On the neck of the knob two projections of the width of the spindle are formed, and when these projections are brought into line with two sides of the square spindle, a solid plate or clamp having a slot cut therein is dropped and embraces both of the projections on the knob, and the square spindle thereby securely attaches the knob to the spindle and locks the two parts together. The slotted plate may, if desired, be retained in position, and also hidden from view by the rose or washer which is usually introduced between the door and the knob. *Patent completed.*

2333. C. Chinnock. *An improved construction of cork-screw.* Dated August 20, 1862.

This invention relates to a novel construction of cork screw, which combines the simplicity of action of the common cork screw with the advantage of lever power of the more costly double action cork screw. It consists simply of the common cork screw (formed, by preference, with a broad knife-edged thread) fitted loosely in a frame, which is intended to rest on the neck of the bottle from which a cork is to be withdrawn. The screw being pointed, and of suitable length, will, on the fixed handle of the screw being turned, first pass down into the cork until its descent is arrested by the frame. The turning being still continued, the frame will then act as a purchase, and the cork will be caused to rise up the screw into the frame. *Patent abandoned.*

2334. S. J. Paris and W. Bate. *Improvements in alphabetical electric telegraphs.* Dated August 21, 1862.

The documents relating to this invention are with the law officers under objection, and cannot at present be seen.

2335. J. C. Schemmann. *Improvements in the manufacture of steel.* Dated August 21, 1862.

This invention consists—first, in manufacturing steel in a granular and spongy state, by withdrawing it from the puddling furnace at particular stages in the process of puddling, and plunging it in cold water. Second, in manufacturing refined steel by enclosing the granular steel (obtained as described) in iron or steel cases, submitting the same to welding heat, and subjecting the cases and their contents to hammering, as described. *Patent completed.*

2336. M. Wilkinson. *Improvements in carding engines, parts of which improvements are applicable to drawing and such like frames.* Dated August 21, 1862.

In carrying out this invention, the inventor firstly applies to the carding engine a cage-like apparatus of peculiar construction a convenient distance below the lower part of the main cylinder, and a somewhat similar apparatus in the same way below the lower part of the licker-in, for the purpose of preventing the greater part of the loose or short fibres of the cotton or other fibrous substances from falling amongst the dirt or other refuse of such fibrous substances, which would have otherwise been the case, and thereby causing the greater part of the said loose and short fibres of the cotton or other fibrous substances to be preserved and more advantageously used than otherwise would have been, thereby causing a great saving in such fibrous substances. Secondly, he applies an improved apparatus for stopping the motion of the carding engines, or of only stopping the motion of the feeding apparatus of such carding engines when the carding ceases to be regularly supplied, or when a larger quantity or lump is attempted to be delivered to the delivery rollers than is required. Thirdly, he applies the last-named apparatus to drawing frames, for the purpose of stopping the said machines, when the quantity delivered from the front drawing roller is defective, or the sliver breaks between the drawing rollers and the delivery rollers. *Patent abandoned.*

2337. G. Davies. *Improvements in governors for steam engines.* (A communication.) Dated August 21, 1862.

This invention consists in combining a spring with a governor spindle, and rods are arranged so as to form a knee-joint, so that the force applied to overcome the rigidity of the spring may be transmitted through a leverage constantly increasing as the resistance of the spring increases, thereby equalizing the action of the said spring—a desirable object to be attained under certain circumstances. The weighted arms of the governor are hung to the top of the spindle in the usual manner. To the weights of the arms are jointed the upper ends of rods, the lower ends of the latter being connected to a sleeve which is fitted snugly to, but arranged to slide freely on, the spindle. A spring is connected at a point midway between its opposite ends to the spindle by means of nuts, which are adapted to the screwed portion of the said spindle. To one end of the spindle is jointed a rod, and to the opposite end a similar rod, each rod being connected to a coupling by means of a nut, one of these couplings being connected to a lug on one side, and the other to a lug on the opposite side of the upper end of the sleeve. The lower end of the latter has a recess for receiving the end of the usual governor lever, through which the movement of the sleeve is communicated to the throttle valve of the steam engine. This recess being formed by two collars, one of which is fast to the sleeve, the other being screwed on to the same, as is also a nut, the striking of which against a nut screwed on the spindle limits the downward movement of the sleeve, and consequently the inward movement of the weights. *Patent completed.*

2338. T. Clements, P. Llewellin, J. Llewellin, and J. Wanklyn. *Improvements in the construction of a self-acting lubricator for lubricating various parts of steam engines.* Dated August 21, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2339. A. Boubee. *Apparatus for casting or moulding glass, and for imitating precious stones or marbles.* Dated August 21, 1862.

This invention consists of apparatus for the purpose of casting glass and mingling the same with enamel, in order to form objects in glass, coloured or not; and also objects presenting the appearance of polished ornamental stone. The inventor proposes to use a mould formed in two halves, which are connected together by a hinge or a spring joint, in order that the molten glass from a furnace may be poured or placed therein, and compressed by a screw or clamp so as to receive the shape of the mould. *Patent abandoned.*

2340. A. Boubee. *An improved veil proctector.* Dated August 21, 1862.

This invention consists of a small elastic cord or band, the two extremities of which are passed through an ornamental metallic tube or tag, furnished with a hook; the ends of the cord being then knotted are retained by the tube. When the veil is adjusted on the bonnet, the elastic cord is stretched thereon and drawn down on each side by the tags, and the hooks are then brought to bear upon the cheeks of the bonnet, whereby the elastic cord is secured, and the veil prevented from being blown back beyond the line of the cord. *Patent abandoned.*

2341. S. F. Griffin. *Improvements in apparatus to be used in the distillation of petroleum, or any oleaginous, resinous, or alcoholic bodies.* Dated August 22, 1862.

This invention is not described without reference to the drawings. *Patent completed.*

2342. A. Whytock. *Improvements in making boxes and preparing sheets for the same.* Dated August 22, 1862.

Provisional protection has not been granted for this invention.

2343. C. Monson. *A new and useful repeating rotary engine.* Dated August 22, 1862.

This invention is based upon the principle that the same current which, when confined under pressure, will revolve one wheel or instrument, may be caused to so operate a larger number successfully, that the aggregate power of the whole, or the useful effect thereof, shall be increased, such current being either of a liquid, aeriform, or a gaseous character. *Patent completed.*

2344. W. Barrett. *Improvements in casting railway sleepers and chairs where tie-bars are used.* Dated August 22, 1862.

These improvements are applicable when casting chairs which have hollow inverted sleepers, similar to those known as Greaves', through which when in use tie-bars are passed and secured by keys. When making a mould for the casting of a chair and sleeper of this description, cores are used to produce the requisite holes in the castings for the passage of the tie-bars; this is usually done by forming prints on the pattern, which produce depressions in the sand into which the core separately moulded is afterwards fitted. Now, in place of making the core for the purpose of producing the hole as heretofore, it is, according to the present invention, made in two parts—one part is of iron, and the other of sand. The portion which is of iron is (when covered with loam) moulded in the upper box on the convex surface, which is produced in the lower box in the same manner as the other parts of the mould. Thus it will be seen that the core is formed complete in the upper and lower boxes, and has not, as heretofore, to be laid in as a separate piece between the two after the pattern has been drawn and the mould is otherwise complete. By this method the holes are cast perfectly clean and true, and require no fitting, as the tie-bar will pass through the holes readily, and the ends where the gibs and cutters come are also as true as possible. Time and labour also is saved in the moulding. *Patent completed.*

2345. E. S. Ritchie. *Improvements in the mariners' compass.* Dated August 22, 1862.

This consisrs in the arrangement and combination of an air vessel with the magnet, or with the same and its card, in manner so as not only to encompass the magnet or magnets, and completely insulate the same from the surrounding liquid, but also to buoy up the card and magnet, or the magnet or magnets, or remove more or less of the weight thereof from the pivot. *Patent completed.*

2346. J. Mackay. *Improvements in the manufacture of soap powder.* Dated August 22, 1862.

This invention consists, according to one modification, in combining together the following, or proportional quantities of the following ingredients—viz., 20 cwt. of soda crystals, 1 cwt. of best yellow or pale soap, 1 cwt. of pearl ashes, 1 cwt. of black or pot ashes, 10 to 20 gallons of water, 1 cwt. of soda ash, 7 lb. of palm oil, 7 lb. of sulphuric acid, 7 lb. of sulphate of soda, and 7 lb. of chloride of lime. The ingredients are all mixed together in a boiler, and boiled by means of a direct fire, or by means of steam, for about five hours, after which the compound is spread out in shallow troughs to cool, being continually stirred until cooled. The resulting product is a granular or or more or less crystallized powder, in which state it is packed for sale. *Patent completed.*

2347. R. Harrington. *Improvements in umbrellas and parasols, and in the manufacture of parts thereof.* Dated August 22, 1862.

We cannot here give space to the details of this invention. *Patent completed.*

2348. H. Twelvetrees. *Improvements in the preparation of washing powders, soap powders, and cleansing crystals.* Dated August 22, 1862.

This invention consists in combining glycerine, or extract thereof, or other oleaginous and fatty matters, such as are used in or suitable for the manufacture of soap, with other ingredients or materials in the manufacture of soap powders, washing powders, and cleansing crystals. *Patent completed.*

2349. D. Moore. *Improvements in breech-loading fire-arms.* Dated August 22, 1862.

The nature of this invention consists in double breech-blocks, one sliding on the line of the barrel, and the other at right-angles thereto, in such a manner that the transverse moving block draws away from behind the longitudinally moving block, and that draws away from the barrel for introducing the cartridge, and is forced up again to the rear end of the barrel, and the laterally moving block comes up behind it to sustain the explosion. To effect this operation the patentee makes use of a peculiar lever, acting upon these blocks in such a manner that, by a simple movement forward or back, the two blocks are slidden, and the breech opened or closed by the one motion of the lever; the said lever is not connected to either block, hence one can stand still while the other block is moved, and *vice versa.* The invention cannot be fully described without reference to the drawings. *Patent completed.*

2350. G. Bottomley. *Improved apparatus for expressing moisture from pulpy or solid substances.* Dated August 22, 1862.

This invention consists in the employment of perforated and grooved plates of metal, or other suitable material, between which suitable quantities of the substance to be operated upon are placed, and then submitted to pressure. *Patent abandoned.*

2351. D. Moore. *Improvements in revolving fire-arms.* Dated August 22, 1862.

This invention relates—1, to a means for attaching the stock, barrel, and cylinder, so that the said cylinder can be swung aside from the stock for the purpose of loading or removing the charge from the piece, but when in position for firing the said parts are held firmly together. In all the arms of this character, in which a rifled barrel is employed, the ball has been slugged or forced into the rifle grooves in the barrel. The ball as it is discharged from the chamber in line with the barrel meets with the obstruction and comparative detention caused by the said rifling, and the recoil of the powder acts to produce an opening between the front end of the chamber and the rear of the barrel, causing escape of gases or "windage." This invention obviates this difficulty, and relates, 2, to forming the forward end of each chamber with a rifled surface, corresponding to the grooves in the barrel, so that the ball entered with the cartridge is slugged previous to entering the barrel, and the explosion and the detention of the balls in being forced into the rifling cause the chambers to press firmly against the rear end of the barrel, thereby cutting off and preventing as much escape of gas as possible. This revolving breech fire-arm is formed with chambers open at the rear end to receive cartridges, with a metallic capsule containing the powder and receiving the ball, a hollow flanged ring being provided for the fulminating material around the base of the cartridge. *Patent completed.*

2352. W. Carwood, W. Boaz, and C. Colwell. *Improvements in apparatus for propelling ships and other vessels.* Dated August 22, 1862.

In carrying out this invention, the patentees construct propelling apparatus in such manner that they produce centripetal action, by which the water is, so to speak, gathered inward, and then expelled in the direction of or in a line with or parallel to the propeller shaft. For this purpose, they set on a propeller-shaft blades or vanes shaped like sections or portions of a hollow sphere, and presenting their concavities in the opposite direction to that in which the vessel is to be propelled; they are so set that, if the full spherical figure of which they are sections were completed, those spheres or full figures would intersect their outermost edges, which are of increasing pitch. They thus exert a confluent action on the water, and produce centripetal force, which gathers the water towards the axis, the water being expelled, as described, contrary to what has hitherto been done by screw propellers, which have exerted a centrifugal action. The blades may be adjustable on a boss, so as to be set at the desired angle in respect on the shaft, and so that they, and hence the vessel's direction, may be reversed. In this case, the boss is not a fixture or the shaft, but is loose thereon, being connected with it by a clutch. The blades most frequently lie transversely to and obliquely on the shaft. *Patent completed.*

2353. T. WOOD. *Improvements in slide valves of steam engines.* Dated August 22, 1862.

The object of this invention is to reduce the friction, and, consequently, the power required to work the slide valves of steam engines. The invention consists in forming an elastic diaphragm in the upper slide and over the exhaust cavity of the valve, which elastic diaphragm is intended so that of itself it would not support the pressure of the steam acting upon it, but it is supported or sustained by a plate placed under the diaphragm, connected with or resting upon anti-friction wheels, pulleys, or rollers which work upon prepared surfaces; or the plate under the diaphragm is connected with one end of a rod, the other end being jointed with a fixed centre. The elastic diaphragm may be formed of metal, india rubber (suitably prepared and protected), or other suitable elastic material. The supporting anti-friction pulleys are placed in the exhaust cavity of the valve, and work upon a prepared pathway made across the exhaust port; otherwise the plate supporting the elastic diaphragm is connected with the segment of a pulley, the circular part of which rests upon a prepared surface in the exhaust port; otherwise, in the case of two valves working back to back, same as in an outside cylinder locomotive engine, the two elastic diaphragms of the valves are connected by a rod passing between the two, the elasticity of the diaphragms allowing for the difference between the movements of the valves, and thus the pressure upon the elastic diaphragm of one valve counterbalances that upon the other valve; otherwise the elastic diaphragm of the valve is connected to a plate or a carriage on the exterior of the valve, which is provided with rollers arranged to work upon a pathway in the valve box on each side of the valve. *Patent abandoned.*

2354. J. EDWARDS. *Improvements in the permanent way of railways.* Dated August 23, 1862.

This invention relates—1, To the making of a continuous sleeper by means of angle or other suitable shape irons, rivetted back to back on to a T-iron, leaving sufficient room between the irons to drop in a double-headed rail, the bottom head resting on the T-iron; a bolt is passed through, which holds the rail in position. 2, The inventor rivets two angle or other shaped irons together, putting a web between. On this iron so prepared he fixes a bridge rail. 3, He places angle or other-shaped irons back to back, and places a web between them; the web is carried above the angle irons, so as to form a stop for the rail, which rail is bolted to this projecting part of the web to hold it in position. 4, He places two angle or other-shaped irons back to back, placing between a web; this web and these angle irons are then rivetted or bolted together, leaving between the angle irons an opening about two inches deep. He then forms a rail of suitable shape, with a feather on one side; this feather drops into the opening left between the angle irons, and is bolted to them. When one head of the rail is worn out, it can be turned on its side, and used in that position, and when the second head is worn out, it can be turned on its other side, and used in that position, thus forming a rail with three heads for running on, thereby effecting great economy. 5, He forms a web of iron, with a suitable hollow and projections in the upper part. Into this hollow he places a suitably-formed rail, which is bolted to the web. This web is very light, and can be turned when one side is worn out, without interfering with the web. 6, He forms a cradle of iron of suitable shape, and into this cradle he drops a double-headed rail, which is bolted to the side of the cradle to hold it in position. 7, He takes a T-iron, and fixes on the top thereof a block of timber, and on the top of this block of timber he fixes a double, single, or bridge rail, using the T-iron as a support. *Patent abandoned.*

2355. F. T. MOISON. *Improvements in the process of cleaning organic matter, and in the machinerg connected therewith.* Dated August 23, 1862.

This invention consists in the treatment of organic matter—more particularly wool and other fibrous materials—charged with fatty and oleaginous or resinous substances, and whereby the inventor separates the said fatty, oleaginous, or resinous substances from such fibrous or other matter. For this purpose, he places the organic matter in a vessel, where it may be subjected to pressure, and he then forces through it—by means of a pump, or by hydrostatic pressure—a current of bi-sulphuret of carbon, or other volatile hydrocarbons, which dissolve the greasy substances, and carry them off with it in a separate receiver, where, by means of heat, he separates the one from the other; and, subsequently, in order to free the organic matter from the volatile oil which may have been absorbed in the mass, he causes it to be traversed by a current of heated air put in motion by a force pump or an ordinary fan. *Patent abandoned.*

2356. J. HINKS and A. DIXON. *Improvements in brooms and brushes, and in the mode of fastening brooms, brushes, and mops to their handles or stules (stuils).* Dated August 23, 1862.

Provisional protection has not been allowed for this invention.

2357. M. K. ANGELO. *Improvements in apparatus used in the manufacture of shellac.* Dated August 23, 1862.

This invention is carried out in the following manner:—The lac or gum is placed in tubes of woven fabric, those which the patentee prefers being woven without any longitudinal seams. He employs metal tubes with gutters or channels at their lower parts, and these metal tubes and gutters are heated externally, and by preference with steam, in a jacket or chamber surrounding the tubes. Through these heated tubes the tubes of woven fabric containing the shellac or gum lac are drawn, whereby the gum as it becomes fluid is caused to filter through the woven fabric, and descends into the gutters of the tubes, the fluid gum being then conducted to and rolled between rollers. The gum in the interior of the woven tubes is prevented passing beyond the lower ends of the heated tubes as the woven tubes are drawn out of such heated tubes by reason of the woven tubes being compressed, and this may be done in any convenient manner; it is, however, preferred to twist them as they progressively come near the end of the heated tubes; or the woven tubes may be drawn over mandrils near the ends of the heated tubes, so as to insure the gum being prevented following with the woven tubes as they pass out of the heated tubes. *Patent completed.*

2358. M. HENRY. *Improvements in stuffing-boxes and their packings.* (A communication.) Dated August 23, 1862.

To simplify the description of this invention, the patentee explains the invention as applied to a piston rod, but it must be understood that it is applied in like manner to valve rods and plunger rods, and other articles or surfaces round which stuffing-boxes and their packings are used. Round the rod are fitted metallic springs or rings. The patentee includes in the term "ring" complete rings, as also springs or pieces of the form of a ring not quite complete, or of a ring cut through, divided, or having a break of continuity at one or more portions of its circumference. Or these rings or springs may be deep rings, or short tubes, or cylinders with or without a longitudinal slit, or division, or break of continuity. The rings may be fitted in grooves or recesses after the manner of piston packing, and they may press on the rod directly, or through the medium of interposed metal rings or segments. Two or more rings may embrace the rod, and be kept to their work by one or more annular or cylindrical springs, which surround the rings, and press on them either directly or through the medium of interposed pieces. In the term "cylindrical" the patentee includes springs of the form of a short cylinder or tube, with a longitudinal slit, division, or break of continuity. This metallic packing takes its fulcrum on the rod or other moving surface round which it is applied, instead of, as in ordinary packing, on the fixed surface of the stuffiing-box or gland. The packing is fitted in a recess or part close to the cylinder-cover or orifice to be packed, that is, as near as possible to the steam or other working fluid. The further part or other end of the stuffing-box or its gland may be extended and fit closely round the rod, to constitute the effective guide for the rod to work through; and by admitting the lubricating material through this part, the rod may be lubricated practically free from contact with the steam or working fluid. *Patent completed.*

2359. C. H. ROECKNER. *Improvements in syphons for discharging or drawing off large bodies of water, and in the mode of charging, fixing, and constructing same, whereby they are rendered perfectly self-acting.* Dated August 23, 1862.

The object and intention of this invention is to dispense with machinery, and simply to employ a steam boiler (which may be portable), or a reservoir containing water, for charging the syphon; and, further, in adapting one or more valves to the legs of the syphon: if two valves, then one of the valves (namely, that by which the water passes out of the syphon into the tidal water course) is so adjusted as to lift outwards, and the other or induction valve lifting inwards. To the extreme upper part or bend of the syphon a pipe is connected, fitted with a cock, for establishing a communication between the exterior of said syphon and an ordinary steam boiler, or it may be a reservoir of water. Now, suppose a syphon thus constructed to be fixed over a coffer dam, for example, one leg thereof being on one side thereof, and the other leg on the opposite side, the former leg being immersed in the water therein, and the outer leg also in water; the inventor proceeds to charge the syphon by admitting steam thereinto from the boiler, or water from a reservoir, thus forming a vacuum in the syphon. He then shuts off the communication between the syphon and the boiler or reservoir, and disconnects the same if desirable. The water now flows out of the syphon by the outlet valve, and continues to do so until the water in the tidal water course reaches the level of the water within the dam; and as the tide rises, the valve prevents the entrance of water into the syphon. In order to avoid the necessity for recharging the syphon periodically, as heretofore practised, he proposes either to form a shallow reservoir beneath and around each leg of the syphon, or to form the ends of the leg turned up so as to contain water, and thus to preserve the vacuum in the syphon. By these means the syphon, when once charged, will continue to work for an indefinite period, and is thus rendered permanently self-acting; moreover, a syphon thus constructed will be found an excellent substitute for a sluice, and infinitely less costly. *Patent abandoned.*

2360. W. E. NEWTON. *Improvements in the mode of and apparatus for treating fermentable substances for brewing and distilling.* (A communication.) Dated August 23, 1862.

One portion of this invention is carried out as follows:—The grain, malt, potatoes, or other substance to be operated upon is soaked for several hours in water, and is afterwards crushed, squeezed, or pressed into a pulpy mass, which is then placed in a vessel, and hot water or steam added until the temperature is raised considerably; or the mass may be heatad by steam pipes until it is converted into a kind of paste. The mass is then passed into a straining apparatus, in which the husks, grains, or unfermentable parts are removed. This removal of the husks and unfermentable particles greatly facilitates the subsequent processes of distilling and brewing, as it economizes heat and prevents the mass from burning. The pulpy mass is then conveyed to a heating apparatus, and the temperature is raised to about 63 deg. of Reaumur, at which temperature sugar begins to form. Here it remains for a certain time, and it is then cooled by passing cold water through it, after which it is passed into the fermenting tubs. The above is the process to be followed for distilling. *Patent completed.*

2361. M. J. HAINES. *Improvements in the manufacture of driving bands or straps.* Dated August 25, 1862.

In the specification of an invention for which provisonal protection was granted to the present pateutee on the 21st August, 1860 (No. 2078), was described the manufacture of driving straps of small strips of leather, hide, or other suitable material, cut to a width equal to the thickness, and to a length equal to the width of the intended strap. The strips had holes formed through them, and were threaded, side by side, on lengths of wire rope, the wire rope thus running longitudinally of the strap. Now, according to the present invention, the patentee binds round the lengths of wire rope with a helical coil of wire, in such manner that the coils lie close up to one another, before threading the strips of hide, or other material upon them, or, in place of employing wire rope thus bound round with wire, straight lengths of wire bound round with a helical coil of wire may be employed. *Patent completed.*

2362. H. R. HUGHES. *Improvements in the construction of sawing machines.* Dated August 26, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2363. W. E. GEDGE. *Improvements in stays or corsets.* (A communication.) Dated August 26, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2364. J. and B. HARRISON. *Improvements in clod crushers.* Dated August 26, 1862.

This invention consists in the use of two, three, four, or more drums, wheels, or discs placed at intervals on a shaft, and a series of bars or lags with spikes cast or fixed on one side thereof, and which bars are fixed at small distances apart, or leaving spaces betwixt them across the edges of the drums with the spikes outward, thereby constituting a spiked skeleton roller or clod-crusher. The bars are formed to fit into dovetailed notches in the drums or discs, and arranged so that the spikes on one bar shall be intermediate to those on the adjoining bars in the line or direction of rotation. *Patent completed.*

2365. G. DAVIES. *Improved machines for washing skeins of cotton, linen, wool, or silk.* (A communication.) Dated August 26, 1862.

These machines are applicable as portable machines, or they may be fixed on a water-course with either a constant or variable level. When intended to be used in the workshop, and not fixed on a water-course, the machine is constructed as follows:—Upon a cistern or vessel having an inclined bottom of either metal or wood (and furnished at its upper end with a compartment to contain the feed water, and at the opposite end with two sluices for the ejection of the same) is fixed the framing of the machine, supporting a sliding cross-beam carrying a suitable number of bobbins, upon which bobbins the skeins are placed in such a manner that their lower part or loop hangs in the water of the cistern. The bobbins are caused to revolve continuously by means of an endless belt passing over a pulley actuated by means of a worm and wheel, and bevel gearing driven by the main or crank shaft, at the same time that the cross-beam which carries them is caused to slide to and fro by means of a connecting rod driven by a crank on the said shaft, and thus a compound movement, similar to that used in hand washing, is imparted to the skeins. The pin of the crank above named is so constructed as to be capable of sliding on the crank, so that the amount of movement given to the cross-beam may be readily adjusted. The whole machine is driven by the direct application of a small steam engine to the crank shaft. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Dec. 10, 1862.

3315. W. Clark, 53, Chancery-lane, engineer. Improvements in umbrellas. (A communication.)

Dated Dec. 16, 1862.

3354. J. Farley, Bolton-le-Moors, engineer, and J. Crowther, Bradford, York, carrier. Certain improvements in steam engines and apparatus connected therewith.

Dated Feb. 9, 1863.

356. J. Mackintosh, North-bank, Regent's-park. Improvements in obtaining and applying motive power.

Dated Feb. 14, 1863.

411. F. E. Walker, James's-terrace, Waterloo-road, gunmaker. Improvements in the construction of breech-loading firearms.

Dated Feb. 20, 1863.

460. W. Marsden, 49, Old Bailey. Improvements in envelopes.

Dated Feb. 25, 1863.

528. T. V. Lee, 6, Bank-chambers, Lothbury, civil engineer. Improvements in machinery for digging, compressing, and moulding peat or turf, and for retorts and kilns for drying peat or turf, and making peat or turf charcoal through the agency of hydro-caloric or superheated steam, and for collecting the products of distillation whilst charring the peat or turf.

532. J. Inglis, Edinburgh, bookbinder. Improvements in machinery or apparatus for folding paper and othor fabrics or materials.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated March 4, 1863.

608. P. Adie, Strand, mathematical instrument maker.

Improvements in means and apparatus for measuring angular and actual distances.

Dated March 9, 1863.

658. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the treatment of certain fibrous vegetable substances with a view to the production of textile materials therefrom. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, March 17, 1863.

2966. F. Trachsel and T. Clayton. Obtaining light, heat, and ventilation.
2983. T. Huntley. Cooking and bath-heating apparatuses.
2987. A. C. Dewies. Lubricator.
3001. J. J. Levisiere. Manufacture of tubes.
3007. W. N. Hutchinson. Protecting the screw of steamers.
3013. T. Greenwood and J. Schofield. Mules for spinning and doubling.
3015. H. Gardner. Treating fibrous materials.
3017. G. H. Ogston. Treating nitrous acid and nitric oxide.
3018. C. Spruyt. Rails for railways.
3019. W. Simpson, Liverpool. Letter boxes and other like receptacles.
3023. J. and T. Mellowdew and C. W. Kesselmeyer. Looms.
3026. J. Whitaker. Pulping, stripping, and slicing edible roots for cattle.
3029. R. R. Holmes. Folding chairs and seats.
3031. J. Shanks. Mowing machines.
3037. W. Booth, J. Booth, and T. Booth. Rotary engines.
3039. H. Burridge. Extinguishing fires.
3040. J. J. Parkes. Lever bell gulls.
3041. E. Marriott and S. Holroyd. Purification of gas.
3043. W. and J. Galloway. Improvements in machinery or apparatus for cutting, shaping, punching, and compressing metals.
3049. J. Faulding. Locomotive engines.
3053. A. Twaddell. Dressing or sizeing warps.
3058. M. Defries. Manufacture and construction of lamps.
3065. C. G. Kopisch. Propelling, steering, and ventilating vessels.
3074. L. Croc. Improved ink.
3075. E. Kirby. Pulley.
3077. A. and H. Illingsworth. Washing wool and other fibres.
3079. E. H. Duru. Motive power engine.
3082. J. Wilson. Hydraulic pumps. (A communication.)
3083. G. Grey. Manufacture of wheels.
3084. F. Palmer. Projectiles.
3106. R. Mushet. Manufacture of cast steel.
3110. C. Kilner, G. Kilner, W. Kilner, and J. Kilner. Manufacture of glass.
3112. R. Hardman. Looms.
3131. J. Steart. Extracting the fibre from aquatic vegetable productions.
3131. T. Walker. Utilizing sewage matters.
3145. W. Clark. Candle lamps. (A communication.)
3156. N. J. Amies. An improved fabric.
3222. E. D. Johnson. Pocket watches.
3231. J. Wheatley. Armour plates.
3296. V. Mirland. Manufacturing paste.
3432. S. Haslam and A. Eatough. Preparing fibrous materials.
132. J. Harrop. Treatment of organic fecal and urinous matters for the purpose of deodorising the same.
347. O. Parigot and A. Grivel. Locks.
406. J. H. Walsh. Breech-loading firearms.
456. J. J. Badart. Preparation of cotton seed cake.
458. N. Thompson. Stopping bottles, jars, and other vessels.
482. A. Dugdale. Throttle valves.
416. H. Wilde. Electric magnetic telegraphs.
542. J. Yates. Manufacture of armour plates.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed March 13, 1863.

2532. E. Balmforth.
2534. H. M. Radloff.
2535. J. Webster.
2542. W. Clarke.
2543. R. Moreland.
2549. R. Cranston.
2574. J. Imray.
2576. J. [illegible]ock.
2577. G. Maw.
2601. J. Farran.
2653. J. L. Hughes.
2691. W. Taylor and S. Buckley.
2694. J. and W. Bradbury.
2997. A. V. Newton.
3240. H. Wilde.
3246. J. Burchall and E. Borrows.
128. W. Hulse and C. L. Haines.
2533. W. L. Tizard.
2540. G. L. Lee.
2547. L. Leigh.
2553. J. Douglas.
2560. W. H. Brown and H. Armstrong.
2570. D. C. Bridge and J. Dyson.
2575. R. R. Jackson and J. Coupe.
2581. B. Hotchkiss.
2613. T. Kennedy.
3257. J. Biggs, J. Johnson, T. Richardson, and T. Arnold.

Sealed March 17, 1863.

2571. J. B. Giertz.
2583. J. Wilson.
2584. A. Prince.
2588. J. Long.
2590. M. Vogl.
2596. J. J. N. Micas.
2607. R. R. and Æ. I. Jackson.
2608. R. R. and Æ. I. Jackson.
2626. E. Dickson.
2672. W. Clark.
2713. A. V. Newton.
2726. J. H. Johnson.
2749. A. V. Newton.
2752. G. Haseltine.
2767. C. Harratt.
2880. T. G. Ghislin.
3164. G. Ranson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

638. J. Lister.
653. M. J. E. Jullienne.
732. T. M. and B. C. Sykes and J. W. Crossley.
719. J. H. Heal.
675. M. Henry.
679. J. H. Johnson.
680. I. Horton and I. Kendrick.
702. W. Wood.
707. F. and W. Cope and W. G. Ward.
773. J. H. Johnson.
697. W. Hudson and C. Catlow.
703. T. Richardson.
717. W. Clark.
734. W. Spence.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

612. T. Porter.
635. C. B. Norman.
631. C. Randolph and J. Elder.
625. E. T. Wright.
1984. W. H. Perkins.
622. C. Coates.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending March 13, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2194	0 8	2202	0 10	2209	0 10	2216	1 0	2223	0 4	2230	0 8
2195	0 4	2203	0 4	2210	0 4	2217	0 4	2224	0 4	2231	0 4
2196	0 6	2204	0 4	2211	0 8	2218	0 10	2225	0 6	2232	0 8
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2199	0 6	2207	0 4	2214	0 8	2221	0 8	2228	0 4	2235	0 4
2200	0 4	2208	0 8	2215	0 4	2222	0 4	2229	0 4	2236	0 8
2201	0 4										

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LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback, 1s.

		£	s.	£	s.
Teak	load	14	0	15	0
Quebec, red pine		3	10	4	10
,, yellow pine		3	0	4	0
St. John, N.B., yellow		5	0	5	10
Quebec oak, white		5	10	6	10
,, birch		3	0	3	10
,, elm		3	10	5	0
Dantzic, oak		3	10	6	10
,, fir		2	10	3	10
Memel, fir		3	0	3	5
Riga		3	0	3	5
Swedish		2	10	2	15
Masts, Quebec red pine		5	0	6	0
,, yellow pine		5	0	6	0
Lathwood, Dantzig, fm.		5	10	6	10
,, St. Petersburg		8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					
Quebec, white spruce		15	10	19	10
St. John, white spruce		14	10	16	10
Yellow pine, per reduced C.					
Canada, 1st quality		17	0	18	0
,, 2nd do		11	0	12	0
Archangel, yellow		13	0	13	10
St. Petersburg, yellow		11	10	12	0
Finlan		9	0	10	0
Memel		10	0	15	0
Gothenburg, yellow		10	0	11	0
,, white		9	0	9	10
Gefle, yellow		10	0	11	10
Soderhamn		9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.					
,, yellow		21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.		0	14	1	4
PUMICE STONE. per ton		5	10	9	0

OILS, &c.

		£	s.	£	s.
Seal, pale	per tun	48	0	0	0
Sperm body		84	0	85	0
Cod		47	10	48	0
Whale, South Sea, pale		43	10	44	0
Olive, Gallipoli		59	0	0	0
Cocoanut, Cochin		53	10	0	0
Palm, fine		38	0	38	10
Linseed		43	0	0	0
Rapeseed, English pale		53	0	10	0
Cottonseed		34	0	44	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
IRON:									
Welsh Bars, in London	per ton	6	10	0	to	6	15	0	2½
Nail Rods	,,	7	5	0	,,	7	10	0	,,
Hoops	,,	8	10	0	,,	8	15	0	,,
Sheets, single	,,	9	10	0	,,	9	15	0	,,
Staffordshire Bars	,,	7	10	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	17	6	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	13	0	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
STEEL:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	0	0	,,	18	0	0	,,
COPPER:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8½	,,	0	0	8½	,,
Fine Foreign	per ton	94	10	0	,,	95	0	0	3
TIN:									
English Block	pr cwt.	5	19	0	,,	0	0	0	2½
Bar	,,	6	0	0	,,	0	0	0	,,
Refined	,,	6	4	0	,,	0	0	0	,,
Banca	,,	6	5	0	,,	0	0	0	nett
Straits	,,	6	1	6	,,	6	3	6	,,
TIN PLATES:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	3	0	,,	1	4	0	,,
LEAD:									
Pig, English	per ton	20	15	0	,,	21	10	0	2½
Spanish, Soft	,,	20	7	6	,,	20	10	0	,,
Shot, Patent	,,	23	15	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	0	0	0	,,
SPELTER:									
On the spot	,,	18	2	6	,,	18	5	0	nett
ZINC:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
QUICKSILVER	pr btl.	7	0	0	,,	0	0	0	3
REGULUS OF ANTIMONY:									
French Star	per ton	42	0	0	,,	0	0	0	2½

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The *Art-Journal* of November, in its description of Benson's Great Clock, says: "It has attracted universal attention, its construction has, we believe, obtained general and strong approval, it is one of the largest chiming clocks as yet manufactured in this country." Benson's new show rooms contain clocks designed by the first artists of the day, and include clocks for the drawing room, dining room, bed room, library, hall, staircase, bracket, carriage, church, turret, railways, warehouse, counting house; with musical, astronomical and every description of clock, from the plainest to the highest quality of which the art is at present capable. Church and turret clocks specially estimated for. Benson's illustrated phamphlet on clocks and watches (free by post for two stamps), contains a short history of clock and watch-making, with descriptions and prices; it acts as a guide in the purchase of a clock or watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world to select a clock. J. W. Benson received a Prize Medal and honourable mention.—33 and 34, Ludgate-hill. Established 1749.

THE MECHANICS' MAGAZINE.

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THE

MECHANICS' MAGAZINE.

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LONDON, FRIDAY, MARCH 27, 1863.

POLITICAL ECONOMISTS AND PATENT RIGHT.

When a man's mind is soaring in the higher flights of science or philosophy, it has a proverbially-known tendency to ignore the earth below, with its material obstacles—its human passions and frailties; and thus the philosopher, while gazing on the unapproachable stars, often stumbles into the muddy ditch. If the theoretical mechanician disregards practical considerations while designing a machine, he produces a thing that will not work. When a general forgets the requirements of his soldiers' stomachs and legs, he is sure to be beaten by a more practical adversary. Should a Plato-like statesman try to enforce a Model Republic, while ignoring Napoleon's dictum, "que c'est le ventre qui fait les revolutions," he will either be hurled from power, or he will ruin his country. Last of all, and this instance is our case in point, when "political economists" wish to make and unmake laws, of the working of which they can take but a bird's-eye view, they are sure to fail most egregiously; as human society is not founded on an ethereal basis of abstract and absolute principles, but rather on the actual realities of mundane existence.

Too often does it also happen that the most powerful minds are influenced by crotchets, particularly when estimating the very things to which they have given the attention of a lifetime. Thus Shakespeare had a weakness for making very bad puns, and Wellington was to the last the gallant and obstinate protector of old "Brown Bess."

These reflections naturally arise in one's mind at the sight of the organized opposition in some of the higher scientific circles, both in England and France, to Patent Right. We find with great astonishment that Monsieur Michel Chevalier, the well-known French political economist, in his introduction to the French Reports of the International Jury of the London Exhibition of 1862, expresses himself in favour of the abolition of Patent Right, and proposes an unworkable plan as a substitute. The Professor of Political Economy in the University of Oxford, the Rev. J. E. T. Rogers, lately read a Paper "On the Rationale and Working of the Patent Laws" before the Statistical Society, in which he expressed somewhat similar opinions to those ennunciated by Monsieur Michel Chevalier, but with some variations that we will indicate further on. The differences are certainly in favour of Mr. Rogers's superior ingenuousness, as many of his objections to patent right could be answered by the counter-arguments he himself, consciously or unconsciously, adduces. Professor Rogers stated that patents are evidently a branch of the ancient and odious system of monopolies, so notorious during the reign of James I. Not that, continued the Professor, all monopolies are necessarily mischievous; the paper-money monopoly of the Bank of England being generally held as advantageous to the public.

A bad origin is evidently no argument against any law; and the entire political constitution peculiar to England has mainly resulted from an organized system of gradually eliminating abuses. Not merely in the reign of James I., but previously, during the time of Queen Elizabeth, there were great complaints made as to then existing monopolies of almost every branch of trade and manufacture, such as salt, vinegar, oil, &c. Even then, however, men of discernment saw and acknowledged the great differences between such oppressive privileges, and those granted for new inventions and discoveries. The great Bacon, then Attorney-General, in a famous debate in the House of Commons concerning monopolies, 20th November, 1601 (reign of Elizabeth), in the course of his speech, very thoroughly defines the difference as follows:—"If any man out of his own wit or industry finds out anything beneficial for the commonwealth, or brings in any new invention, which every subject of this kingdon may use, yet in regard of his pains and travail therein, Her Majesty perhaps is pleased to grant him a privilege to use the same, only by himself or his deputies, for a certain time; this is one kind of monopoly."

M. Michel Chevalier asks the questions: Is a patent for an invention founded on a basis of positive right? Does an invention in the manufacturing arts afford the character of ownership in a determinate manner? Is it a thing that a man can claim to the exclusion of others, that is to say, can appropriate to himself, even for a duration limited to only fifteen years?

Mr. Rogers observed that property, as defined by economists, must be capable of appropriation, division, limitation, and identification. It does not, however, follow, continues Mr. Rogers, that all property is necessarily of a material description. A man's character, the debts due to him, his trade mark, his signature to a cheque, (and, we would add, his invention), were allowed by the learned Professor as coming within the definition of property.

As to the abstract right of an originator to his original idea, there never appeared to us that there could be the slightest doubt in the matter. What is more free than thought; and what thing can be more essentially the property of a man than the emanation of his brain?—what can be more determinately the property of a creator than the object he has created? What other property can be so easily hoarded away, or taken out of the country, or even carried with its possessor to the grave? The inventor says to society: "I have an improvement that will increase the present means of production; give me an exclusive right to use it for a limited period, in order that I may be remunerated for the time and energies I have spent to enable me to make this discovery, and the time and the energies I must still exercise before I can make my discovery available. Your entire, complete, and perpetual possession of my idea will merely be deferred for a short period." Mr. Rogers asserts, however, that the inventor's bargain with the public is entirely one-sided; that he keeps his own secret if he thinks it his own interest to do so, but demands a monopoly in his discovery if he thinks it desirable to communicate it to the public. As far as we understand Mr. Rogers, it appears to us that he is ignorant of the practical patent law, as it at present exists. A patent is completely invalid if a patentee in his specification in the least attempts to mislead the public as to the nature of his invention, or even if the invention be insufficiently described. The bargain between society and the inventor is nullified if the patentee does not completely fulfil the contract. Mr. Rogers further demurs to the contract between society and the inventor, on the plea that, "No one can call that a fair bargain which is involuntary on one side and voluntary on another." We cannot conceive a more childish train of reasoning. If society does not want the patented invention, the patentee cannot force the public to use it, just as the writer of a dull book cannot force the public to buy and read his effusions. The patentee can with as little reason demand a royalty as the author can demand the purchase of his work. If an inventor chooses to keep his idea a secret, and does not take out a patent (as is sometimes done from the present unsatisfactory state of the law), what right has the public to demand a revelation of the secret? The right of the strongest? But that right could only exist by an annihilation of all right, and a return to the good old days of—

> "They shall take who have the power,
> And they shall keep who can."

We would remind Mr. Rogers of another University man, an intellect of a very different calibre to his own, Dr. Wollaston. That famous chemist discovered a particular mode of preparing malleable platinum; he practised this process in secret for many years, and realized a large sum of money by it. The Doctor only disclosed the process on his deathbed, and probably described it only incompletely.

Mr. Rogers believes that "material inventions are either the result of a sudden conception, or of the elaboration of well-known and general laws;" and Monsieur Arthur Legrand, another of the writers in the French Jurors' Reports on the Exhibition, says: "Each year, each generation, brings with itself a tribute of novelties, that at a given instant are translated into practice with a kind of spontaneousness *(spontanéité)* when the time is come—that is to say, when a demand has made itself felt. Each thing is thus divulged according to its own time by the natural effect of a want born, as it were, out of the progress acquired by science and industry. One could even add, that he who makes a discovery is merely the particular instrument of the generation to which he belongs, and that his century, rather than himself, deserves the title of inventor."

This elaborate theory of the fire of genius being a kind of spontaneous combustion, is very remarkable. How is it, that, if an invention be such an easy matter to make, being merely "the result of a sudden conception, or the elaboration of well-known and general natural laws," that Professor Rogers himself has never made an invention? He has not even brought a new argument to bear against patents, his paper being merely an industrious compilation of objections that have been made long ago. Why has not Monsieur Arthur Legrand made himself, "l'instrument de la génération à laquelle il appartient." Is it for the same reason that even mushrooms require a particular kind of soil and favourable circumstances for their "spontaneous generation"? We utterly deny, and we appeal to all scientific history to disprove the assertion, that the century has always distinctly put the questions for the solution of inventors. Whenever a really original patent is taken out, we certainly see that it suggests a host of plagiarisms; but that is scarcely what M. Arthur Legrand means.

In a similar strain M. Michel Chevalier says, page 166:—"The fact is, that there is at present a common and almost inexhaustible fund of notions applicable to industry, and that almost always, when the want of any new process is once felt, there is reason to suppose that ten persons, instead of one, will make the necessary discovery, and at about the same time." Such assertions show either utter ignorance as to technical matters, or complete oblivion as to the many requirements of the manufacturing arts, on the part of Monsieur Michel Chevalier, Monsieur Arthur Legrand, and Professor Rogers. To merely give a few instances at random: How is it that no sufficient means yet exist for preventing accidents on railways and in mines? Why is there yet no complete arrangement for getting an exact number of revolutions from an engine driving machinery for spinning fine numbers? How is it that for more than twenty-five years we have burnt coke instead of coal, and thus wasted millions' worth of fuel in our locomotive fire-boxes? A good and simple boiler feed-apparatus was always a desideratum, but Giffard's injector was only brought out a few years ago, after boilers had been in use for more than a century. Why is there no good means of preventing the unequal wear of the cylinder of a horizontal engine? Any practical man could instantly jot down a number of additional similar problems still pending for a solution; but we will ask, how is it that some five or six hundred inventors (as proved by the Patent Indices) have to try their hands at any really great mechanical or chemical questions before it is solved?

Mr. Michel Chevalier says:—"If I invent any mechanism to-day, another man may invent the same thing to-morrow, and more; nothing proves that another did not invent it yesterday." In a somewhat similar way, Professor Rogers says:—"The law grants a monopoly to the first applicant; but by a perfectly independent train of thought, or application of labour, another person may have discovered the same thing; but the privilege is bestowed upon the first to ask for it." To these dicta we would reply, that it very seldom happens, unless there be a plagiarism, that two mechanical arrangements to produce the same effect, are exactly similar. It does certainly occur that very similar patents are sometimes taken out during the six months' provisional protection, and this forms one of the objections to that clause of the law. We have, however, noticed that this clashing of invention generally takes place when a previous successful patent has urged upon people whose trade it threatens the necessity of evading or superseding the invention.

In any case, where is the harm of granting a patent to the man who has first brought the invention to maturity? Should the plate and the stakes be refused to the swiftest horse? "First come first served," is a homely dictum; but it is of universal application; and a quarter of an hour will decide the result of a battle, or will settle for ever the destinies of a nation. Ought we to refuse to an ingenious and active man the reward for his improved process, because another man behind him is blundering and procrastinating with a similar idea?

Mr. Rogers states that he does not wish to abolish copyright, inasmuch as, though two persons could invent the same thing, it was impossible two persons could write independently the same book. We are surprised that Mr. Rogers, who must know something of the Doctrine of Chances, could make such a shallow objection; for there would certainly be very little likelihood of two books being written in precisely the same words; not so, however, as to the ideas, as any one can see that precisely similar views are often enunciated in works that have been simultaneously published. It may be objected in favour of copyright, as against patent right, that the former does not prevent the publishing of a book containing similar ideas differently expressed. This, however, is only the case with some kinds of books; and it is also notorious that many patents embody the main idea of a previous invention, while evading the law by adopting different, and sometimes superior means, to carry out the original idea. A patent does not cover a principle, and copyright does not protect the main idea of a book from plagiarism.

We further find in the French Report:—"Nineteen times in twenty, or ninety-nine times in a hundred, the labours of *savants* have furnished the basis of inventions in the manufactures and the substance of the patents. *Savants* abstain from taking out patents for their scientific discoveries. The text of the French law is such that they could not found valid patents on these discoveries. Therefore, if those who have the principal share in inventing are excluded from the profits to be acquired by the possession of inventions, how can others base a right to claim them as their exclusive property?" Any one can see by the lists of the some eight thousand English and French patents that are annually taken out, that but a small proportion of these patented inventions can be said to trace their origin from the studies or laboratories of purely scientific men; certainly not to the extent of 99 per cent.; in fact, we should be inclined to assert that the relative proportion was exactly the reverse. In any case, the man of pure science is rewarded by the honours and respect that generally attend scientific eminence, even when unaccompanied by wealth. To render practicable most scientific discoveries, and to bring them into the market, generally requires different aptitudes to those exercised in making a scientific discovery. The men of pure science, however, have not been always indifferent to the blandishments of patent right. We can cite Sir David Brewster and his patent kaleidoscope, Liebig and his manure, and other patents, Schönbein and his patented gun-cotton, &c. Gay Lussac patented several of his discoveries, among which was the famous patent for separating the stearine from the ealine of tallow. The noble-minded Arago has often strenuously and with great eloquence defended the right of a scientific discoverer to patent the result of his labours. It has been whispered that no less a man than Faraday, being prevented by the existing etiquette among men of science from patenting some discoveries in gas lighting, permitted his brother to take out the patents. We might multiply these instances; and, at any rate, it will be seen that it is a mere matter of choice with any experimental philosopher to patent his discoveries before divulging them to the world.

Mr. Rogers seemed to believe that the stimulus of self-interest is required to urge on invention; but he very properly rejected as impracticable the proposal to institute a Board for awarding prizes to such inventions as might be thought of public utility. Not so M. Michel Chevalier, for this gentleman proposes (*Exposition Universelle de Londres*, tome 1, Introduction, page 167), "to reward by a special gift (*dotation speciale*) any ingenious man who, after a certain time of trial, should have rendered signal service to society by any discovery. This has been the way adopted in France, with regard to the inventors of photography." With playful irony it is added:—"These recompences would not ruin the public treasury; there would be no necessity to award them very often." We certainly thought that the Utopian theory of bounties to inventors had long been exploded, even in the "higher regions" of political economy.

If the investigations of such a Board of Examiners be secret, it would be difficult for the public to believe in the impartiality of the awards. A public tribunal of merit would be a daily and hourly arena for the gladiatorial combats of rival inventors. How could such a Board be constituted? Upon what principles could its decisions be based? If merely the utility of the invention be taken into consideration, must valuable discoveries resulting from chance or a fortunate inspiration be excluded from competition for the bounty? As Butler in his "Hudibras" says, with some truth and more wit:—

> "All the inventions that the world contains
> Were not by reason first found out, nor brains;
> But pass for theirs who had the luck to light
> Upon them by mistake or oversight."

Should the merit of the inventor himself be taken as a criterion, and the fact be considered at a money value, of a man having spent his fortune and his lifetime in the realization of an invention of perhaps less utility than another discovery; the result of a fortuitous observation or of a sudden inspiration?

M. Michel Chevalier cites the reward given by the French Government to Daguerre, the inventor of daguerreotyping. This grand reward for a really magnificent discovery consisted in a paltry life annuity of £250 (6,000 francs). By a curious coincidence the same instance was cited against patent law in the Report of the Jury on Philosophical Instruments exhibited at the Exhibition of 1851. (See "Reports by the Juries on the Exhibition of 1851," Class X., page 246.) "The great advance of photography is chiefly due to the avoidance of patents in connection with its improvement." Monsieur Michel Chevalier, and the learned jurors of Class X., could scarcely have chosen a more unfortunate "modern instance" for deducing their "lame and impotent conclusions." The discovery of Daguerre dates from 1839; but, previously to this, in 1834, Mr. W. H. Fox Talbot had invented the means of fixing the images of the camera obscura on paper. This discovery was almost neglected till 1847. Mr. William Henry Fox Talbot took out no less than five patents for discoveries connected with photography. His first patent was described in the Mechanics' Magazine, Vol. 35, page 188, and, as they came out, his other patents were described. The English patent of Daguerre (No. 8194, dated 1839) was bought for £1,600; it was thus still valid in 1853. Photography, nevertheless, did not take its rise in France, where Daguerre's patent was public property, but in England, where the patent still existed. Photography only appeared in France in 1847, twelve years after the discovery of Daguerre, and, besides, the improvements made in France in the processes of photography did not originate with the public, but with Monsieur Niépce, the successor of his uncle, M. Nicéphorus Niépce, one of the originators of sun-painting.*

It is simply incorrect to state that patents have been avoided in connection with the improvement of photography. More than 200 patents have been taken out for inventions and improvements in the photographic arts and in the use of the stereoscope in England alone. There are always a greater number of patents annually taken out in France than in England.

Mr. Rogers stated that it was difficult to decide whether the Patent Laws were or were not a stimulus to invention; as they had always existed in this country it is impossible to say what we should have done without them. We may add that the only civilized country in the world still without a patent law is Switzerland. The probable reason that Switzerland has no such laws consists in the fact that this country is divided into Federative Cantons, constantly disputing with each other. A patent for a single Canton would, of course, be no protection.

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* Monsieur Nicéphorus Niépce, in December, 1827, submitted some pictures taken upon silvered copper plates smeared with the bitumen of Judaea to the Royal Society, having, as early as 1814, made experiments to fix the images produced in the camera obscura. Daguerre's English patent is taken out in the name of Miles Berry, as a communication from himself and J. I. Niépce, jun.

Mr. Rogers cited the civil engineer, the late I. K. Brunel, as being an opponent of patents. The late Mr. Brunel's father, M. I. Brunel, who was more of a mechanical engineer, was in favour of Patent Right. Indeed, we consider it to be a noticeable fact that several civil engineers in successful practice are averse to patents. We might cite Mr. John Scott Russell, Sir William Armstrong, and the late Messrs. Cubitt and John Meadows Rendel, although nearly all of these gentlemen greatly owed their rise in life to successful patents. The reason of this opposition seems very obvious to us. Being in possession of a large and varied practice, and often requiring separate mechanical details for each particular undertaking, it was natural that the arrangements they adopted should sometimes clash with already existing patents. It is painful to have to pay a royalty for a mechanical detail that might have been invented by a man's own self. A thing looks so easy to achieve when it is once done !

Thus behind the well-meaning band of desk-philosophers, pioneering the way for a clean sweep of patent right, there is a serried phalanx of men who see that it would be for their own interest to abolish these rights—a band of men who would like to swell their incomes by gratuitously appropriating the results of other men's labours, and would look upon the stagnation of invention as a safeguard against a depreciation of their manufacturing plant.

II.

ENGINEERING LITERATURE.

A practical little pamphlet* on the forging, hardening, tempering, expansion, annealing, and shrinking of steel has been just issued; and it well deserves the attention of any apprentice, or even workman, wishing for additional information on such an important branch of workshop experience. The little book is evidently written by a good workman for the use of workmen; and although defaced by some faults of grammar and style, it is nevertheless clear and precise. Of course mere reading can never teach a man to file straight, or to forge and temper a chisel; nevertheless, the aid that books can afford is no more to be despised than good advice is to be contemned. The work contains, step by step, practical directions upon the forging, hardening, and tempering of steel chisels for turners, &c. The title is rather a misnomer; the scientific theories as to the formation, chemical constituents, &c., of steel are now being so much discussed and so often patented, that the title, "The Management of Steel," would lead us to expect a latent puff of some newly-patented process.

To those delighting in ingenious and novel combinations of mechanical motions, a good compilation of the greater part of the movements known must always be valuable and interesting. A work describing five hundred of the known mechanical movements, illustrated by sixteen large lithographed plates and several woodcuts, has been lately published by Mr. Joseph Willcock, Mem.Soc.Eng. Such a book must necessarily be mainly a compilation, and thus the main French and English sources of the book we have examined are the "Practical Mechanic and Engineers' Magazine (1842 and 1843)," Willis's "Principles of Mechanism," Olinthus Gregory's "Treatise on Mechanics," Delauncey's "Cours Elémentaire de Mécanique Thèorique et Appliquée," Buchanan's "Essays on Millwork," White's "Century of Inventions," "Bulletin de la Societé Industrielle de Mulhouse," &c. The author begins by describing the parallel motions, and he then gives the escapement, intermittent, and the movements by means of pulleys and bands. The teeth pitches, and the making of wheel-patterns, are treated on very completely. The circular motions, and their changes into rectilinear movements, as well as the differential and some miscellaneous movements, epicyclic trains, &c., then follow. A very complete collection of the movements used in gas apparatus is then given; and following these, a collection of various hydraulic and pneumatic apparatus, and of the lathe chucks manufactured by Messrs. Holtzapfel and Co. Some of the plates of diagrams are very well lithographed. We miss some well-known motions; amongst others, Watt's sun-and-planet motion; and, to take a more modern instance, the quick-return motion used by Mr. Whitworth in his shaping machines. These and others could, however, be added by a possessor of the work; and an industrious student of engineering could thus, with the addition of manuscript notes, in course of time make this book a foundation for a unique and very valuable collection of mechanical movements.

II.

INSTITUTION OF CIVIL ENGINEERS.

At the meeting of the Institution of Civil Engineers on February 17, a discussion upon the two Papers, "On the Drainage of Dundee," by Mr. J. Fulton, and "On the Sewerage of Newport, Monmouthshire," by Mr. A. Williams, Assoc. Inst. C.E., F.G.S. (which will be found reported in the Mechanics' Magazine of Feb. 13), occupied the whole of the evening.

It was remarked that, although the author of the first paper had stated that no ventilation whatever had been applied to the sewers in Dundee, yet, with apparent inconsistency, he spoke of the gases of the sewers being prevented from escaping into the streets and houses by trapped gullies. It was urged that it was dangerous to lay down a system of sewers over an entire town, without in the first place providing, as part of the scheme, for the fullest and freest ventilation, particularly at the higher levels; and that care was specially necessary in towns presenting naturally steep gradients. Disease had broken out in well-sewered districts, which was traced to the connection of the house drains with unventilated sewers; the highest portions of the town suffering most severely. If the sewers of Dundee were sweet, it would lead to the inference that they must have been badly constructed, and that there were joints and crevices which let out the gases; for with a perfectly tight sewer, the gases must rise to the upper extremity, and escape into the houses through the house drains.

It was thought that the sections of the Newport sewers were of the most approved forms, and that the bricks employed there were admirably adapted for the construction of such sewers with economy. But it was contended that there was no advantage in building brick sewers sufficiently large for a man to pass through, unless those dimensions were required to discharge the sewage flowing into them. In every instance where there were two rings of brickwork in the invert, there should be two rows of "headers" at or about the springing, so as to bond and tie the work together where the arch commenced.

In a hilly town the whole system of sewers should not be so connected together as to allow of the accumulation of the sewage gases in the higher parts of the district. Where the gradient was steeper than 1 in 200, and a sewer was one mile in length, it should be divided by steps or falls, and there should be a flap valve upon the upper or discharging end of the sewer, and at least two street grates at this point, so as to ensure thorough ventilation. Where the sewage was discharged into a river, having a low summer level and a high flood level, it was not always practicable, or desirable, to carry the whole of the sewage in flood down below the summer level. In such cases the arrangement adopted at Windsor Castle might be followed. Formerly a large brick sewer discharged itself into the Thames, close to the Queen's private walk, and was a source of nuisance. By fixing a cast-iron pipe at the bottom of the sewer, and putting a slight dam in front of the junction, all the ordinary sewage was discharged by the iron pipe below the summer level. The brick sewer took away all the storm waters, which could be passed into the river with impunity, as they would be in extreme dilution, and the river itself would be in flood.

It was stated that the invert of the main outlet sewer at West Ham, which was 4 ft. 6 in. in height by 4 ft. in width, was laid for about half-a-mile at the level of low water of spring tides, and then for 2½ miles with a fall of 3 ft. per mile. The surface of the ground was from 10 ft. to 12 ft. below high water in the Thames, and the subsoil was so porous, that when the trench was excavated the water could not be pumped below a certain level. A cast-iron invert was therefore devised, and upon it cement blocks were laid to above the water line; the other portions of the sewer being built in the ordinary way. About three miles of that sewer had been in use for nearly two years, and no difficulty was found in keeping it clean, although the velocity of discharge was mainly that due to the surface gradient, or head.

As the question of town sewerage was of daily increasing importance, the principles which should be adopted might be briefly stated. Every sewer should be straight from point to point, and at every change either in the line or the gradient, there should be a manhole or a lamp-hole, affording means of access to the sewer, as well as providing ventilation. A cesspit should be formed at the side of each of these ventilating shafts, to catch the detritus from the roads; and the gully grate and entrance should be over it, and not directly above the crown of the sewer, as was the case in some parts of the metropolis. Between the side chamber and the shaft charcoal filters should be fixed, so as to deodorize the foul gases before passing into the streets. Sewers of unequal dimensions should never be level at the inverts; it was safer, as a rule, that they should meet at the crown. In the former case, the larger sewer would dam back the sewage in the smaller tributary, and prevents its being flushed out. At Carlisle the main sewer had a fall of 1 in 700 for a mile and a quarter. It was frequently liable to be flooded, and at times the water line was from 18 feet to 20 feet above the level of the invert. That sewer had been in operation for six or seven years without requiring any outlay for cleansing. At every manhole there was a groove in the brickwork to receive a stop-plank, by which the sewers could be flushed out in sections, either by accumulated sewerage, or by the admission of water from the water works.

The fouling of rivers, by allowing undiluted sewage to pass into the nearest available water courses, was a question of serious importance. It was believed that the cheapest element to remove soil refuse was water, and that the readiest method was by a proper system of sewers. If it was not worth while commercially to pump the fluids and solids, for the purpose of appropriating them to agricultural uses, then the solids should be removed by deposition and filtration, and the liquids be deodorized, before entering the rivers and water courses. The land was the proper place to which the soil refuse should go, and if the authorities of a town could not dispose of it at a profit, they ought to be compelled to incur the necessary expenditure for carrying it to some place where it could be beneficially applied, without creating a nuisance.

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* On the Management of Steel. By George Ede. London: W. Tweedie, 337, Strand. 1s.

It was remarked that, the sewers on the south side of the River Thames were all provided with ventilators, having side-pits which prevented stones and mud from entering the sewers. In confirmation of the statement, as to the advantage of a supplementary pipe outlet to discharge at low water, it was mentioned that a similar arrangement had been carried out at Battersea eight or ten years ago, and subsequently at four or five other outlets of the main sewers on the south side of the River Thames. With reference to the question of cleansing sewers, it was thought that the method adopted at Dundee was complicated and expensive; and that if a greater fall had been given to the sewers, and a supply of water had been obtained occasionally, as required, from the water company, both the first cost of the works, and the working expenses, would have been reduced. The plan pursued in the metropolis was simpler and cheaper. In the pipe or sewer a valve was fixed, which could be kept closed until a head of water accumulated; when this valve was opened, the rush of water cleared away any deposit, including macadamised matter and stones.

It was contended that no system was perfect which permitted accumulations in the sewers; for if the velocity of the flowing sewage was insufficient to prevent the deposit of sand, grit, or other insoluble substances, such matter ought not to be allowed to enter the sewers, and by suitable gully traps this could be easily prevented. Street gullies should be so constructed as to prevent the entering of road detritus into the sewers, and to arrest the escape of noxious effluvia, while at the same time they should provide for the admission of a downward current of air, to aid in the ventilation of the sewer. With reference to the direction of the air passing through sewers, experiments showed, that it was sometimes with and sometimes against the sewage flow, and that it was not governed either by the velocity, or the temperature, or the direction of the sewage, but appeared to be determined by the various points of ingress and egress, and by the number of gullies and ventilating shafts.

There was still a diversity of opinion as to the proper size of sewers; but it was believed that, in ordinary town districts, calculating upon a maximum fall of rain of one inch in half-an-hour, and that it all passed directly into the sewers, the following proportions would prevent silting, if the district was thickly populated, and the house drains were connected with the sewer:—

Diameter of Sewer.	Inclination.	Drainage Area.
Inches.		Square Feet.
6	1 in 50	200
9	1 in 100	400
12	1 in 150	650
15	1 in 200	1,000
18	1 in 250	1,400
21	1 in 300	1,800

To this it was replied, that no specific rules could be laid down which would apply to every town in the United Kingdom, each of which must be dealt with according to the local circumstances and peculiarities of the case. The character of the outlet, the rate of inclination and the nature of the surface of the ground, the rate and amount of the rainfall, the number of houses draining into the sewers, the extent of the population, and other things, all required consideration.

The extension of the main sewerage works of the city of New York, under the administration of the Croton Aqueduct Department, was alluded to, as affording an illustration of the application, to a particular case, of the results arrived at, after the consideration of the facts and arguments which had some years ago been elicited by what was popularly known as the "small-pipe controversy." The material adopted was brick, set dry, or in hydraulic cement, as the circumstances of the locality required; and the cross section was an egg-shape. In determining the sizes of the sewers, the Croton Aqueduct Department assumed that the maximum rainfall on Manhattan Island never exceeded one inch in an hour, and the capacities of the several main sewers were adjusted to provide for that amount, in addition to the maximum prospective house sewage flow of the several districts to be drained. As the streets of the modern part of New York were laid down in right lines—right lines with confluent junctions were adopted for the sewers. The bottoms of the sewers were also, as far as practicable, constructed on uniform gradients; but level lines for the bottom of sewers were considered objectionable, as decreasing the hydraulic mean depth of the sewer at the outlet, where it was most needed. Receiving basins for the road detritus, with connecting culverts for passing the water into the sewers, were erected at the corners of the streets, and in other suitable localities, and it was stated that these arrangements were found sufficient to keep the sewers free from any permanent deposit.

In reply upon the discussion it was remarked that, at Newport, the cost of a brick sewer 14 in. diameter, at a depth of 10 ft., was only 7s. 7d. per lineal yard, including junction pipes for house drains, and that in the same locality the cost of a pipe sewer 12 in. diameter would have been as much, if not more. Brick sewers sufficiently large for a man to pass through, had also been built there for 11s. per lineal yard, whilst at Dundee the average prices were stated to have been for tubular drains 13s., and for brick sewers 33s. per lineal yard.

In conclusion, the necessity for the thorough ventilation of sewers was insisted on; and as the only way to render sewer gases innocuous was by a large admixture of atmospheric air, there should be frequent inlets for the admission of air, as well as numerous outlets for the escape of the foul gases. With regard to the fouling of rivers, no doubt by vastly increasing the local burdens upon trade and manufacture, means might be provided for depositing the heavy matters, and for deodorizing and disinfecting the fluid portions of sewage; but such nuisances were, to some extent, the penalty incurred for concentrating the population in dense masses, and it was hopeless to expect, that the rivers in the neighbourhood of large manufacturing towns could ever be restored to the former clearness.

March 24, 1863, John Hawkshaw, Esq., president, in the chair. The first Paper read was "Description of the Lydgate and of the Buckhorn Weston Railway Tunnels," by Mr. J. G. Fraser, M. Inst. C.E.

It was assumed, that the aggregate length of the tunnels now daily traversed by railway trains in the United Kingdom amounted to 80 miles; and supposing their cost to have been on an average £45 per lineal yard, their construction must have caused the expenditure of six and a half millions sterling. Up to the present time this interesting branch of Civil Engineering had not been much discussed at the Institution; as the Minutes of Proceedings only contained accounts of a total length of about three miles, involving an outlay of about one quarter of a million sterling. Each tunnel had its own history, and its construction demanded peculiar treatment, according to the character of the strata, the springs of water, &c. If particulars of these works were transmitted to the Institution from time to time, more effectual measures might in many cases be practised, with advantage to public economy.

The tunnels forming the subject of this communication were both executed under the immediate superintendence of the author, as resident engineer for Messrs. Locke and Errington, the engineers-in-chief.

The Lydgate Tunnel, on the Oldham branch of the London and North Western Railway, was driven through the coal measures. A longitudinal section which accompanied the Paper, prepared from actual measurements taken during the progress of the works, illustrated the geological details. Faults were common in this formation: sometimes severing it in the line of the dip, and at others in the line of the bearing. Several distortions were encountered, and at one point, one-half of the tunnel was in shale and rock, and the other half in wet and loose shale. The total length of the tunnel was 1,332 lineal yards; of this about 1,046 yards were on a straight line, and 286 yards on a curve of 74 chains radius; its width was 25 ft. at the level of the rails, with a height of 20 ft. Four permanent shafts, each 9 ft. in diameter in the clear, were sunk at intervals of about 230 yds., of the respective depths of 53½, 80, 75¼, and 53 yds. They were lined with 9-in. brickwork, or with 12 in. of masonry, except in the rock. An old colliery shaft, which had been closed for many years, was also re-opened, and a cross-heading was driven from it into the tunnel, a distance of 13½ yds. When foul air was met with, a supply of fresh air was forced into the workings by means of fans until a junction was effected between the headings. There was a considerable amount of choke-damp in the neighbourhood of the old coal workings. To overcome its effects, a bore-hole was sunk from the surface, which was lined with an iron pipe, and through this fresh air was forced into the tunnel. The sinking of the shafts was carried on in the usual manner, by excavating through soft material, and by blasting and drilling through rock. The average rate of progress was 11 lineal yards per month. After attaining a depth of 20 yards, the material was raised by engine power.

A bottom heading was driven from the faces worked from the cuttings at each end; but with these exceptions the tunnel was mined by a top-heading, 6¼ ft. by 4¼ ft., first being made for the full distance of each length. The crown was protected by larch bars and poling boards, and after the ground was secured, it was gradually widened out to the shape of the tunnel, the same description of timbering being continued to about 10 ft. above the formation level. The contract price for the excavation, including the timbering, was 4s. 6d. per cubic yard. In the construction of a tunnel, the masons, or bricklayers, should, as a rule, commence the lining as soon as possible after the ground was prepared for them by the miners. The lengths mined at each face varied according to the nature of the ground; averaging, in loose shale, 3 lineal yards, through stony shale 5 yards, and through rock 8 yards, or in some instances 10 yards. The prices paid to the miners ranged from £8 to £18 per lineal yard, one half of the total length amounting to £12, or less.

The centres used were skeleton ribs, set about 1¼ yard apart; but at the leading ends two ribs were fixed close together. This description of centering was found to answer very well. The price allowed for setting each rib was but 8 shillings. The masonry of the side walls was of coursed rubble. The arch for a length of 632 lineal yards was turned with fitted rubble; but owing to the scarcity of good bedded stone, the remaining length was built of brickwork. The average quantity of masonry per lineal yard was 12½ cubic yards, and the contract price throughout, 20s. per cubic yard. The mortar was composed of Barrow stone-lime mixed with coal-ashes, in the proportion of 2 to 1, ground by heavy iron rollers, and used fresh. Its setting properties were most satisfactory. The spaces between the crown bars, called the mid-feather, were filled up with brickwork, and the bars themselves were left in where they had "sagged."

The first length of the tunnel was keyed in on the 27th of October, 1854, and the last was finished on the 21st of March, 1856, a period of seventeen months, or equivalent to about 80 lineal yards completed per month, exclusive of the sinking of the shafts. The contract price for the tunnel was £26 per lineal yard through rock, and £35 16s. per lineal yard through shale, the average price being about £30 per lineal yard.

The Buckhorn Weston Tunnel, on the Salisbury and Yeovil Railway, was 739 lineal yards in length, 25 feet in extreme width, and 20 feet in height above the level of the rails. It was constructed through Kimmeridge clay, intersected with veins of loose rock. These veins acted as conduits for a large body of water, amounting to about 90 gallons per minute, which flowed in at the crown of the tunnel for nearly one-half its length. To remedy the evil effects arising from this volume of water, a heading 5 ft. by 5 ft., was driven above the tunnel, and about 10 yards on the upper side of it, for a length of 200 yards. A pipe, 12 in. diameter, was laid in this heading, and the remainder of the space was filled in with loose stone. The water was thus intercepted, and conveyed away from the work. It was originally intended to execute this tunnel by means of a bottom heading, sufficiently large for ordinary waggons, from the cutting at the west end, and to sink two shafts.

After the heading had been driven for a length of 200 lineal yards, it was found that the action of the atmosphere caused the sides to bulge in so much that this plan had to be abandoned. A smaller heading was then substituted, and three additional shafts had in consequence to be sunk. The shafts, which were only temporary, were 8 ft. square, and were lined with timber. Their cost amounted to £1 10s. per lineal yard of tunnel.

The mining was performed in a similar way to that of the Lydgate Tunnel; a top heading being first driven from each shaft. The average price for mining and tipping was 4s. 6d. per cubic yard, and the quantity amounted to 80 cubic yards per lineal yard of tunnel. The lengths mined at each face ranged from 3½ lineal yards in heavy ground, to 5 lineal yards in favourable strata. The average cost of mining was £30 per lineal yard, exclusive of the shafts. The crown bars were of larch, 18 in. diameter, and were fixed about 18 in. apart.

The centres were strongly braced, and were placed about 1¼ yards apart. Each rib contained 35 cubic feet of timber, and 285 lb. of wrought iron in bolts and straps, and the cost of setting amounted to 6s. per lineal yard of the tunnel. As side pressure was anticipated at the commencement of the work, the first ten lengths were built with an invert, which contained 4 cubic yards of brickwork per lineal yard. Further experience showed, however, that this was not necessary. The tunnel was built throughout of brickwork, upwards of six millions of bricks being used, and the average quantity per lineal yard of tunnel was 20 cubic yards. For a length of 390 lineal yards, where the water occurred, the work was 2 ft. 8 in. in thickness. The spaces behind the brickwork were filled in solid, and throughout the heavy ground three bars were left in, on an average, in each length. As there was no sharp sand in the neighbourhood, burnt clay, fine sand, and broken bricks were ground together, and mixed with Bridgewater hydraulic lime in the proportion of 2 to 1; the result was perfectly satisfactory.

The first length of this tunnel was keyed in on the 6th of October, 1858, and the last was completed on the 17th of February, 1860, a period of sixteen months. The total cost had amounted to £53,000, or £72 per lineal yard; detailed particulars being given of the cost of the different items.

ACTION OF HEAT AND FORCE UPON MATTER.

A PAPER on this subject was read before the Manchester Literary and Philosophical Society, by Mr. J. C. Dyer.

Confining his observations to the "action of mechanical forces"—apart from those depending on the electrical magnetical, and vital forces —he held the former to depend on the inherent properties of matter, as gravity, inertia, and elasticity, each coextensive with the material universe.

That force cannot in any case be treated as an abstraction or as apart from the matter in which it resides, though several authors have had recourse to such an abstraction to account for phenomena attending the operation of force. Mechanical action, depending on the elastic force generated by the agency of carbon and water, being of so great importance, it is desirable to obtain some settled knowledge as to how this arises. We all know that by combustion of the former the latter is converted into steam. That which passes from the burning coals through the boiler plates and into the water to form the elastic vapour, is called heat; but whether it be a union of heat with the water, or only a transmitted mechanical action on the water, causing its atoms to separate and assume the elastic state, remains a question for solution; and of late several able writers have offered explanations of this phenomenon founded on the supposed nonentity of heat and the agency of mechanical force to form steam, and thus rejecting the latent heat theory which before seemed to account for the heat absorbed to form steam. So far as the latent heat theory serves to explain phenomena, the mechanical creation of heat is uncalled for, since it is unphilosophical to assign new causes when those before accepted clearly met the case. Yet we have seen two elaborate essays, by Mr. W. J. M. Rankine and Professor Tyndall, each based on the force heat assumption, but without affording any solid proofs of its application to the phenomena adduced by them.

Mr. Rankine states that "heat produces an increase of temperature and of expansive force in bodies; that the changes from the solid and liquid states to the gaseous state, is accompanied by an increase in volume; that heat which produces those effects is known by the name of sensible heat, as attaining the form of heat, and in short making the body hotter." Again, that "changes of volume are attended with changes of molecular arrangement, perceptible or imperceptible, and that the latent heat of expansion or evaporation consists of heat that disappears in overcoming pressure and the attraction of the particles of the body." In reference to the nonproduction of heat by the moving force exerted in waterfalls, the following solution is offered, viz.: "It is natural to suppose that the motion during this phenomenon (the falling of a mass of water) has not been destroyed, but has been converted into revolutions of the particles in vortices or eddies too small to be perceptible by any of our means of observation, and that the centrifugal force of such eddies is the cause of the tendency of hot bodies to expand, melt, and evaporate."

The first-class of phenomena above cited are plainly accounted for by the doctrine of latent heat, but the latter explanation about waterfalls passes Mr. Dyer's comprehension. He submits that what is said to be natural to suppose concerning the revolutions of particles in vortices and eddies too small to be perceived is too obscure and questionable to be accepted in explanation of anything. If Mr. Rankine has no better mode of accounting for the nonappearance of heat from the force expended in waterfalls than the above, his defence of the generation of heat by force fails, and the balancing the force by the resistance at the foot of the falls is just as open to view as the falling force itself; so that the motions, too small to be perceived, are supererogatory inventions. The dynamical origin of heat is also set forth by Professor Tyndall, in a Paper "On the Forms and Action of Water." Examples are therein adduced of vast mechanical forces exerted by the formation of water, and by its changes from the states of a solid, liquid, and vapour. He says that "on the combination of oxygen and hydrogen to form water weighing 10lb. an energy was expended, the atoms clashing together with a force equal to that of a ton weight let fall from a height of 23,757 feet. In falling from the state of vapour to that of water an energy was expended equal to that of a ton falling from a height of 3,700 feet, the moving force of the stone avalanches of the Alps was but as that of snow-flakes, compared with the energy involved in the formation of a cloud. In passing finally from the liquid to the solid state, the atoms of 10lb. of water exercised an energy equal to that of a ton weight falling down a precipice 550 feet high."

Now, the union of the gases to form water, the evaporation of it to form steam, and freezing it into ice, are chemical changes, and the forces called into action by them are chemical forces, which cannot be measured by that of gravity in falling tons or even ounces; but the mutations of heat attending those changes are measured by degrees, when passing from the latent to the sensible state, and *vice versa*. Of vapour in the air, the Professor says, that "though forming only about 0·5 per cent. of the atmosphere, for every ray of terrestrial heat struck down by the air, fifty, sixty, or seventy rays were destroyed by the aqueous vapour. This vapour permitted the solar rays to reach the earth, but intercepted the terrestrial rays in their escape towards space," and he adds that "in the presence of such experiments, it was easy to see how the snow of the Alpine mountains, and how the ice, should be squeezed through the moulds formed by the valleys, and then these mountain glaciers were as much a proof of heat as of cold, and to produce the vapour to condense and form glaciers required as much heat as would raise five times the weight of the glaciers of cast iron to its melting point." The heat required to convert water into steam as it passes from the sensible into the latent state is a known quantity, so also is the amount required to convert ice into water; but that required to melt a pound of ice and evaporate a pound of water would fall far short of melting five pounds of cast iron.

That no mechanical energy is exerted in the conversion of water into steam is obvious to our senses, since evaporation is the most gentle, imperceptible, as well as the most universal action in Nature's laboratory; and although the elasticity of the steam itself exerts mechanical force equal to the atmospheric pressure, chemical force alone is concerned in evaporation, and therefore cannot be compared with falling bodies, so that the alleged energy and clashing force of atoms, in the actions of water cited, are wholly imaginary; nor can philosophy assert any fact relating to mechanical action which cannot be proved by experiment or established by plain induction; and in the cases cited, no one can know anything about the occult forces and energies of the motions of atoms attending the mutations of water. Great respect is due to both of the gentlemen whose essays have invited the above strictures; but the search after the truths of science "should not halt before high names."

Mr. Rankine, in offering demonstrations of the dynamical origin of heat, allows that heat disappears and becomes latent in water, in passing from the solid to the liquid state, and from this into vapour, as also that the same amount of heat is given out and reappears as sensible heat, upon the reversal of those changes; thus in substance admitting the latent heat doctrine, whilst denying the materiality of that which does so enter into a latent and reappear in a sensible state, and calling this heat the production of force, when no mechanical force whatever is called into action by those mutations of water. They are, however, plainly explained by the agency of heat, in its chemical union with water and its evolution from water. Although the evolution and absorption of heat from the compression and expansion of elastic fluids bears a constant relation to the amount of compression and to the compressing force, yet this is not the case, as Mr. Rankine supposes, in the resistance to compressing forces by liquids and solids; the amount of compression in these latter cases depends upon the relative mobility of the particles of the bodies, and we find forces of great energy, exerted against yielding solids, as in carriage and other springs and elastic bodies, are in continuous action without producing any sensible heat when no compression takes place. If it were true that acting forces always produced their equivalent in heat, then the powerful movements of railway springs, hydraulic presses, and the like, should raise intense heat in the steel springs and water exerting such force, and the absence of any heat in such cases must be fatal to the dynamic creation of heat.

EXPERIMENTS IN EXPLODING FIELD MINES BY ELECTRICITY.

THE editor of the Washington *Chronicle* gives the following description of some experiments which he recently witnessed with field mines, which were exploded near the forts on the Virginia side of the Potomac by means of electricity :—

Arriving on the ground, we learned that His Excellency the President was there, accompanied by the Secretary of War, General Heintzelman, General Barnard, General Abercrombie, and many other officers of less note. Soon after there was a gaeat explosion immediately in our front; the earth opened and vomited forth stones, shot and shell, vertically, horizontally, and, in fact, in all directions.

Immediately around us were a number of the officers of the signal corps, busily engaged in connecting the wires of a field telegraph to its support, and among them we saw Professor Beardslee, the inventor of the telegraph apparatus now used in our armies. From him we learned that he was exhibiting the application of his new electro-magnetic machine to the explosion of mines, and that he was now ready to fire another.

Quick as the wires could carry the spark there was another explosion even greater than the first, and the air was again filled with earth and smoke, stones and exploding shells; some of the latter falling in uncomfortable proximity to our person.

A third mine was exploded in the same manner. In fact, we should judge from appearances that the ground in front of our forts had been extensively mined, and it is only necessary for Professor Beardslee to connect his apparatus with them, pass the word, and they will be exploded.

An order was now passed from Col. Alexander, of the Engineers, who appeared to have charge of the operations, for the crowd to fall back to a greater distance, as a *fougasse* was about to be fired.

Taking up our position close to the President, we watched for the *fougasse*. We heard a heavy explosion, as if some of the internal fires of the globe were escaping, and the earth belched forth a volcano of smoke, stones, and exploding shells, even more fearful than before. It rained stones for acres around and in front of it, and must have carried annihilation to any assaulting column in the neighbourhood. Immediately after this explosion, there was a rush of the soldiers to see the *fougasse*, but a heap of ruins only showed where it had been placed.

CHILDS' MACHINERY FOR CUTTING VENEERS.

FIG. 1.

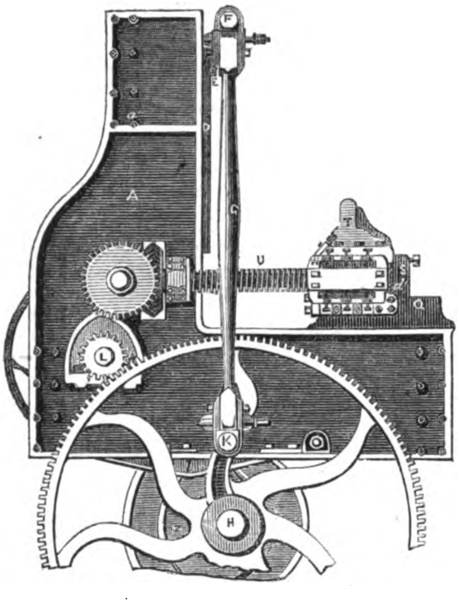


FIG. 2.

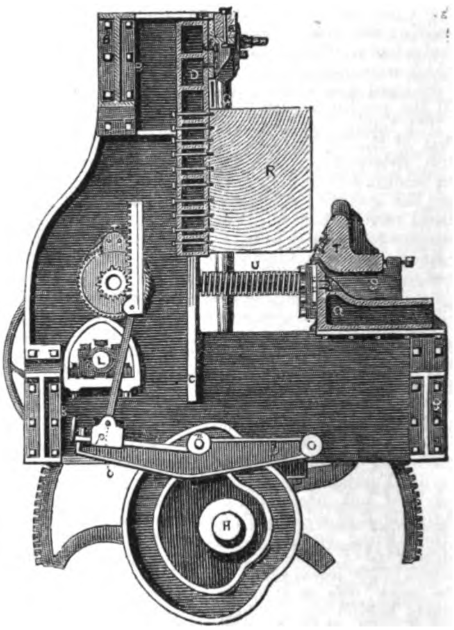
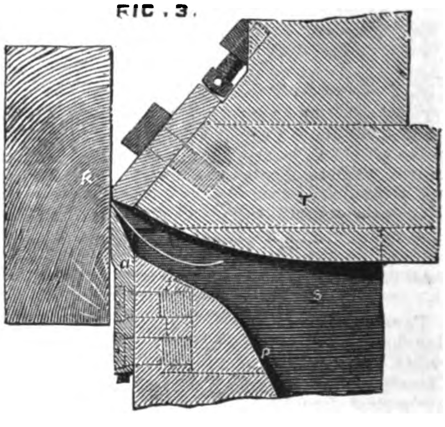


FIG. 3.



CHILDS' PATENT MACHINERY FOR CUTTING VENEERS.

MR. A. B. CHILDS, of Oxford-street, has recently obtained a patent for improvements in machinery for cutting veneers. The invention is illustrated in the annexed engravings.

For this purpose the log or block from which the veneers are to be cut is firmly secured to a bed plate by means of bolts which pass through the bed plate and screw into the log or block. The bed plate is perforated with holes at equal distances apart, and a sufficient number of them to receive a requisite number of bolts to hold the block firmly thereto. The bed plate may be placed in a vertical, a horizontal, or a diagonal position, but it is preferred to place it in a vertical position. The bed plate, together with the block carried thereby, has a motion up and down a distance somewhat over and above the width of the largest block to be cut; and this motion is by preference communicated to it by means of two cranks and two connecting rods, one at each end of the bed plate. The knife, when making the cut, is stationary, but is capable of being moved towards and from the bed plate by the action of the feed motion, which, by means of a double ratchet, causes it to recede immediately after the cut, and again to move forward immediately before the cut a distance depending on the thickness of the veneer next to be cut. The knife consists of a straight cutting edge with one side bevelled off, and is firmly secured to a knife block which is made to slide towards and from the bed plate. A little before the edge of the knife there is a pressure bar made adjustable by set screws and bolted firmly in its required position to a pressure beam so as to give a very heavy pressure on the surface of the block immediately on the point or line of cut. The pressure beam is also made adjustable by set screws, so that it may be set towards or from the edge of the knife, according to the amount of pressure required and the thickness of the veneer to be cut, and then held firmly to the knife block in its required position by means of bolts. The knife block is held firmly in its relative position to the bed by means of powerful feed screws, so that any amount of pressure required can be given to the pressure bar.

The main feature in this invention is the peculiar method of applying the pressure to the surface of the block, at or near the line of cut and of graduating the same to the different thicknesses of veneers; also the method of feeding the knife and of graduating the feed to the different thicknesses of the veneers to be cut. By this method veneers are cut more perfectly and sound, and more free from cracks, from any kind of wood and to any thickness required.

Fig. 1 is an end elevation; fig. 2 is a vertical transverse section; fig. 3 is a vertical transverse section of the knife and pressure bar on a larger scale.

The frame is composed of two slide pieces A, A, and three girts B, B, B, secured together with bolts. There is a vertical guide C formed on each of the side pieces A, A, projecting inwardly, and a bed plate is fitted to slide freely thereon. A cross head E is bolted to the upper part of the bed plate D with a wrought-iron cross beam F secured thereto; this cross beam is longer than the bed plate or cross head, and extends out by the frame at each end with wrist pins made thereon, to which the upper end of the connecting rods G, G, are attached. The main shaft H is hung below the frame, and fitted to revolve in boxes or hangers, which are bolted to the bottom of the frame; this shaft has a large gear wheel fixed on each end outside of the frame with a crank pin K set therein, to which the lower end of the connecting rods are attached; the crank pins are set a suitable distance from the centre to give the required motion or length of stroke to the bed plate. The driving or pinion shaft L is fitted to revolve in boxes, which are set in the rear part of the frame; this shaft has two pinions fixed thereon, one near each end outside of the frame, that gear into and drive the large gear wheels J. A portion of the lower part of the sides of the frame project out in front a distance sufficient for the knife block Q to rest and slide upon. The knife block extends across from one side of the frame to the other. The knife *a*, shown more clearly in Fig. 3, is secured to the block and made adjustable by a series of set screws. A portion of this knife on the side next to the log or block or from the edge downward is ground straight or in a vertical plane, so that it may have a bearing against the wood a little below the edge of the knife, or, in other words, a continuous bearing from the edge a short distance downward. The knife block at each end has an upward projection S, on which the pressure beam T rests; the pressure beam extends the entire length of the knife block, and has its bearing at each end, and is made adjustable by a set screw, and when properly adjusted it is firmly secured at each end to the knife block by bolts, which screw down into the projections S, S. The pressure bar *d* stands at an angle of about forty degrees from the plane of the bed plate, and in that position is held firmly to the pressure beam by a series of bolts; the pressure bar is also made adjustable by set screws *f*. The peculiar shape of the lower part of the pressure bar directly back of the cutting edge of the knife is an important part of this invention; it is its peculiar shape directly in front of the cut, and the amount and manner of applying the pressure, that enables the patentee to cut veneers without cracking the wood in process of cutting.

It is necessary to have a very heavy pressure directly on the line of cut with a slight compression of the wood below the cut, and gradually diminishing to nothing in order to cut the veneers without cracking them.

The operation of the machinery is as follows:— By giving motion to the large wheels by means of the pinions, the connecting rods and the block of timber R will be made to slide up and down on the guides and cut a veneer from the block at every revolution of the large gear wheels J, J. During a portion of the downward motion of the bed plate while the cut is being performed, the roller *n* rolls on the smallest part of the cam Z, which is on a true circle from its centre, thereby allowing the lever *l* to remain at rest in its lowest position during the whole time the cut is being performed. Immediately after the cut is completed, and while the crank pins are passing under the centre, the cam lever *l* rises to its highest position, forcing the rack *u* upward with it, which causes a pinion in connection with levers and panels to turn to move the knife block a sufficient distance to allow the log or block R to pass up without touching the edge of the knife *a*. During that portion of the upward motion of the bed plate, while the log is passing the knife *a*, the roller *n* rolls on the largest part of the cam Z, and immediately after the log R crosses the knife *a*, the cam lever together with the rack *u* drop to their lowest position again, thereby causing the knife block to be fed forward a distance depending on the thickness of the veneer next to be cut, in addition to the back motion before given. By this arrangement for a feed motion wood can be cut to any thickness required, from the very thinnest veneer up to three-sixteenths of an inch in thickness. The use of the slide block *p* is to vary the distance of motion given to the rack *u*; for instance, if by changing the ratchet one tooth should be found to be too great a change, the side block *p* can be set so as to take any part of a tooth, even the hundredth part, if required, thereby graduating the thickness of veneers to any point of nicety required. This slide block can also be used to change the distance of motion required to be given to the rack *u* from thick veneers to thin, and from thin to thick. When the log or block R is entirely cut up into veneers a thumb screw is turned so as to raise the pawls up, to enable the ratchet to revolve freely in either direction; the knife block may then be run back by attaching a belt to the pulley on the feed shaft *j*, or by any other practical device.

BROWNE AND ARMSTRONG'S GAS METERS.

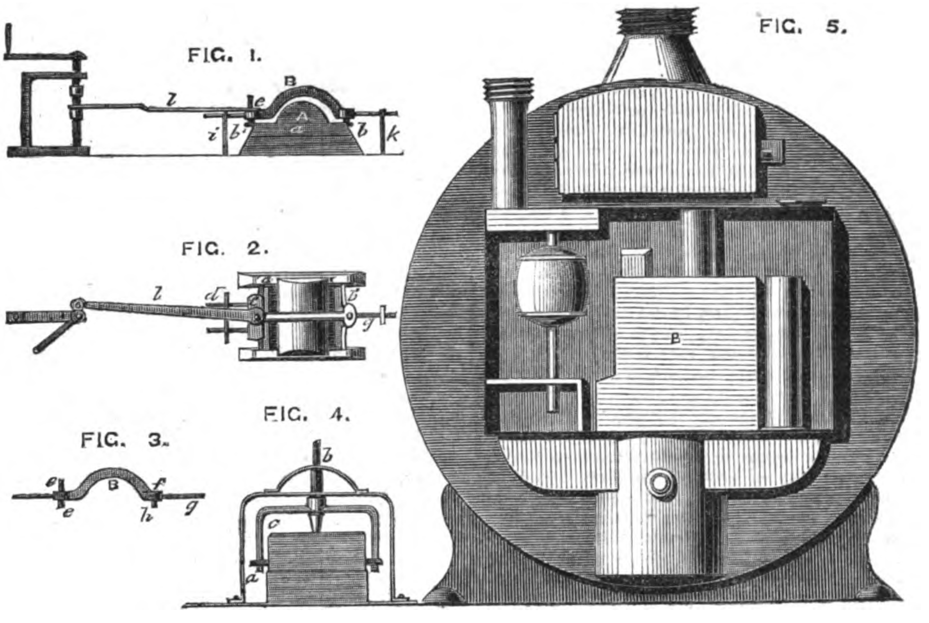


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

BROWNE AND ARMSTRONG'S IMPROVEMENTS IN GAS METERS.

In meters as at present constructed much gas passes unmeasured during the too and fro movement of the valves, by the pressure of the gas raising the valve from its seat, both in wet and dry meters; this may be entirely obviated by the use of the valves recently patented by Mr. W. H. Browne, of Theobald's-road, and Mr. H. Armstrong, of Manchester-street, which we illustrate in the annexed engravings.

The invention, as far as relates to dry meters, consists—first, in means of causing the efficient working of the ordinary slide valves. This is accomplished by connecting each slide valve loosely to a frame carried over or round the valve furnished at back with a pin which works in a hole formed in an upright, while the other end of the frame is united to the connecting rod, whereby motion is communicated to the valve; pins also project from the fore part of the frame, and work in holes formed for their reception in other uprights. By means of the frames, the action of the valves both in advancing and in the back stroke is the same, that is to say, the valves are drawn in both directions, in contradistinction to their being drawn in one direction and pushed in the other. Second, in driving rotary valves in dry gas meters from the lower part of such valves. For this purpose eyes are fixed in the lower part of the rim of the valve, and a wire or wires fastened on the valve spindle are passed through such eyes. The main purpose of the improvements before alluded to is to prevent the valves from being lifted from their seats, and thus allowing the gas to pass unmeasured, as occasionally takes place with valves as ordinarily fitted and constructed.

Fig. 1 of the engravings is a side elevation, and fig. 2 a plan. A is the valve, free to move to and fro on the surface framing of the ports. The valve is formed in a piece with side frames *a a*, and *b* b^1 are cross-bars between the ends of the side frames; these cross-bars have a hole or aperture made about the centre to receive studs from a loose frame B, now about to be described. This frame B is shown detached in side elevation at fig. 3; it is bent to fit over the valve A; *c* is a cross-head, in which one end of the frame terminates, into which two horizontal guide-pins *d d* are screwed or otherwise fixed; *e* is a vertical stud, which projects both above and below the cross-head *c*; *f* is a similar but smaller cross-head at the opposite end of the frame, carrying a horizontal guide-pin *g*, and a vertical stud *h*, projecting from the under part of the cross-head *f*; *i* is an upright, carrying two eyes, in which the guide-pins *d d* move to and fro; and *k* is a similar upright, with one eye, in which the guide-pin *g* works; the lower part of the vertical stud *h* enters the aperture formed in the cross-bar *b*, while the vertical stud *e* enters the aperture in the cross-bar b^1; the connecting-rod *l* is connected to the frame B by an eye in one end thereof, through which the upper part of the vertical stud *e* passes; the other end of the connecting-rod is attached to a crank in connection with the index. As many similar valves to that shown in the drawings may be fitted to a dry gas meter as may be required.

Fig. 4 is an external elevation of a rotary valve for dry gas meters; *a a* are the eyes, which are fixed at the sides and on the lower part of the valve; *b* is the valve spindle, and *c c* wires fastened thereon, the lower ends of which we pass through the eyes *a a*.

The improvements in wet gas meters thus consist in forming an enclosure, open at top, round the aperture leading from the float-case into the drum of the meter, and in making the aperture of very small diameter, in order to prevent any sudden pressure acting directly or without check in the float-case, and thereby forcing and keeping down the float.

Fig. 5 is an elevation of a wet gas meter, the float-chamber having the front plate removed. A is the float, B is a three-sided partition fitting against the drum-case and the bottom of the float-chamber, but open at top; a small aperture is made in one of the sides thereof, through which communication for the water in the float-case and inside of the partition and interior of the drum takes place. C is the overflow pipe, which we prefer to place outside of the partition.

W. CLISSOLD'S DRIVING BELT.

We last week alluded at some length to the interesting subject of machinery belts, and we also gave a short account of the belt patented by Mr. W. Clissold, of Dudbridge, Gloucester. The following is a description of this novel mode of constructing that class of driving belts which bind by lateral pressure on their pullies, and thereby take so firm a hold as to remove the liability to slip, which is a disadvantage common to ordinary driving belts. This improved class of belts (which already forms the subject of letters patent granted to Mr. Clissold, and bearing date the 22nd day of May, 1860, No. 1,266,) may be described as an endless band bevelled at its edges to fit into V-grooves formed in the periphery of the driving pullies, such band being composed of layers of leather or other material connected together by pins, or otherwise. In practice it has been found that the beneficial thickness of which these belts may be made is limited, by reason of the unequal strain upon the outer and inner layers, or parts of the material composing the belt, and, consequently, that the strength of such belts cannot with advantage be indefinitely increased. From this cause it was deemed necessary to limit the application of belts constructed of a wedge or taper form in cross section to uses where no great strain was likely to be experienced.

FIG. 1.

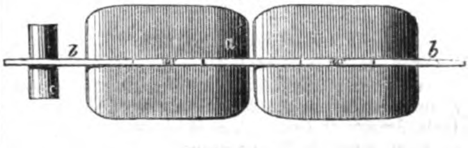


FIG. 2.

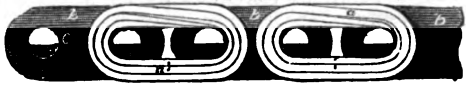


FIG. 3.

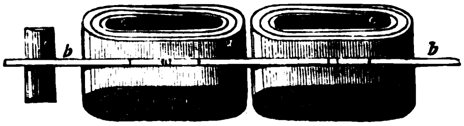
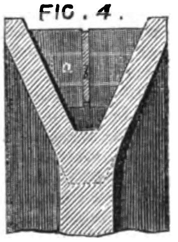


FIG. 4.



The object of the present invention is to increase the strength of belts of this class so as to render them equal to the heaviest work to which it has hitherto been or may hereafter be found desirable to apply driving belts or bands. To this end, instead of making bevelled edged belts, as heretofore, with one continuous length of bevelled edge, they are formed of links, which, while presenting good contact surfaces to the V-grooves of the pulleys (against which they will press laterally without touching the bottom of the grooves), will so divide the unequal strain upon the inner and outer surfaces of the belt hitherto found so destructive to the wedge form of belt as to render the strain nugatory. The friction or wedge-shaped links may be made of strips of leather or other flexible material coiled up to the ordinary figure of a link, or they may be made of moulded rubber or other suitable plastic material. These links are connected together by link plates carrying a stud at either end, which studs will enter the space in two adjacent flexible links and hold them together, forming, in fact, fulcrum pins for these links to turn on as they pass around the driving pulleys. The accompanying engravings show the improved construction of link driving belt in several views, the friction links being in this example composed of coils of leather. Fig. 1 represents the outer face, and Fig. 2 a side elevation, of a portion of the belt drawn to full size; Fig. 3 is a view of the inner face of the belt, and Fig. 4 is a cross section showing the application of the belt to a V-grooved pulley.

The wedge-shaped links *a*, *a*, fit into the groove of the pulley, but not so as to bed therein, the object being to allow of the belt tightening on the pulley by sinking deeper into the groove as the breadth of the links decreases by wear. These links *a* are each made by preference of two parts to facilitate the forming of sockets for the reception of the link plates *b*, *b*, and the parts *a*, *a*, are coupled together in the middle by filling pieces a^* cemented thereto, or otherwise attached to the parts *a*.

From the above explanation it will be understood that this mode of making driving belts permits of any strength of link being used according to the work to which the belt is to be applied. The patentee also remarks that belts constructed on this principle may be made wholly of metal, in which case he prefers to line the V-grooves of the pulleys with wood, to prevent the grinding of metal against metal.

SEA-GOING SHIPS.

On Wednesday Captain Cowper P. Coles, R.N., delivered a lecture on the subject of "Sea-going Shield Ships," at the lecture-room of the Royal United Service Institution, Whitehall-yard. Sir J. Pakington, M.P., presided on the occasion, over a numerous and evidently an influential audience.

Captain Coles commenced by remarking that at this moment, when the construction of the navy occupied so much general attention, he trusted that no apology was necessary for his entering on the subject. In 1860 he delivered a lecture in that room in which his views with regard to the construction of iron-clad ships of war were first brought before the public. Since that period the construction of line-of-battle ships and wooden men of war might be said to have been given up by all the maritime nations of the world; and the necessity of having armour-plated ships had been so fully recognized that everywhere they were to be found building or built in sizes varying from 7,000 to 700 tons. But the form and construction of these ships were still an open question. It had been said that shield ships could never be good sea-going vessels on account of the great difficulty of masting them; but he was able to state that they could be masted with the greatest ease, and so as to spread one-half more canvas than could be carried in the old method. It must therefore be assumed that they would have a corresponding advantage in sailing. Rigid iron tubes would be used for the lower rigging, and these would form with the mast, also of iron, a tripod. The lecturer pointed to a model representing a shield ship of nearly the same tonnage as the "Defence," and to a diagram representing the ship cleared for action, showing that nothing was left aloft but the iron tripod lower mast. He also showed by the model how the square sail was to be taken in from below, and the yards braced fore and aft. If there should be a breeze the topsail could be kept set so as to steady the ship. The lecturer proceeded to enumerate what he deemed the advantages of the iron tripod mast, which were fully described a short time since in the MECHANICS' MAGAZINE. As to the comparative merits of the revolving shield ships and the broadside ports iron-clad ships now building, he would consider them under the following heads:—Their offensive or destructive powers; their defensive or resisting powers; their speed and sea-going qualities; their light draught of water and handiness in steering. The present transition of navies and the great progress made in constructing large guns, especially in America, left us as little doubt that we were to pass from 68-pounders to 300-pounders as that we had passed from 36-pounders to 68-pounders, and it was clear that the iron-clad broadside ships could not carry this heavy ordnance. The comparative destructive powers of these ships must depend on the weight of the broadside guns as one element of comparison; but it must not be forgotten that a heavy projectile able to destroy a ship might inflict only a small amount of injury if broken up into a broadside. Comparing the "Prince Albert" shield ship with the "Defence" broadside ship as to offensive and destructive power, the broadside of the "Defence" was 560 lb. for a tonnage of 3,700, while the "Prince Albert" threw a broadside of 1,120 lb. for a tonnage of 2,529, with a power of fighting half her guns on either side, giving her, in fact, two broadsides of 560 lb., or making her equal to two "Defences," although the "Prince Albert" was 1,600 tons smaller. This being the case, he was at a loss to know how Lord Clarence Paget came to the conclusion that a shield ship engaged on both sides would be at a disadvantage as compared with a broadside ship, for it was obvious that the "Prince Albert" would be equal to two "Defences" when fighting on both sides. He might go farther, and say that the "Defence" could fight only every other gun, and therefore her broadside was reduced to 280 lb. Besides this, the "Prince Albert" drew 5 ft. 8 in. less water than the "Defence." Captain Coles then went into similar statistics with regard to the "Valiant," the "Warrior," the "Favourite," and the "Royal Sovereign," with a view of proving that under all these four heads there was a great superiority in the shield ships over broadsides, while their light draught of water would enable them to use the present dockyards, notwithstanding their much heavier ordnance. Captain Coles proceeded to explain in detail a model ship, embodying all his inventions, contrasting it in every essential quality with the best specimen of a broadside ship, the "Favourite," the result of which comparison was to show the superiority of his pet invention, the "Naughty Child," over the "Favourite" in every respect. Perhaps not the least important of all the points of superiority of the new invention was that, while in the ordinary broadside vessels the arc of training guns was not more than 40 degrees, in the shield vessel it was as much as 310 degrees. Another was that in the new invention the living and the fighting portions of the vessel were distinct—a consequence of which was that the ship never required "clearing for action," but was always ready. As to the mode of building ships, if his opinion were asked, he would say "protect the vital parts with thick iron plating," but he would reduce the plating elsewhere. Lord Clarence Paget, in the last session, said that he (Captain Coles) was not a shipbuilder, and that his plans were not fit for the public service. How was it, then, that the Government had adopted many portions of his inventions? He did not profess to be a shipbuilder. He was a practical seaman and a gunner, and he had, with the assistance of naval architects, produced plans to meet necessities as they had arisen. Having urged that the adoption of his scheme would save the country millions of money, he thanked his brother officers for their sympathy and assistance, and especially one gentleman whom he saw present, who, when he was struggling on the miserable pittance of a naval captain, came forward and gave him that substantial aid without which his inventions could never have been brought to any practical result."

TRIAL OF THE "ROYAL OAK."

THE official trial of the "Royal Oak" was resumed on Tuesday last. The vessel was steamed some distance below the Nore, and six runs were made at the measured mile at full speed, the following being the results:—In the first run the time was 5min. 30sec., the speed in knots was 10·909, the number of revolutions of engines 60, and the pressure of steam 21; in the second run the time was 4min. 13sec., the speed in knots 14·229, the number of revolutions of engines 59, and the pressure of steam 19½; in the third run the time was 5min. 30sec., the speed in knots, 10·909, the number of revolutions of engines 60, and the pressure of steam 20; in the fourth run the time was 4min. 18sec., the speed in knots 13·953, the number of revolutions of engines 59½, and the pressure of steam 20; in the fifth run the time was 5min. 30sec., the speed in knots 10.909, the number of revolutions of engines 59, and the pressure of steam 19; in the sixth run the time was 4min. 17sec., the speed in knots 14·009, the number of revolutions of engines 61, and the pressure of steam 20. In all the runs the vacuum forward and aft was 24. The mean speed of the six runs was 12·487 knots.

The result of the trial of the "Royal Oak" at full speed may thus be considered satisfactory, when her immense weight and size are taken into account. The engines of the "Royal Oak" are of 800-horse power (nominally), while those of the "Black Prince" are 1,250-horse power; and yet on the occasion of the last trial trip of the latter vessel, she only attained a mean speed of 12·209 knots, the "Royal Oak" thus beating her by a quarter of a knot an hour. The actual displacement of the "Royal Oak" during her trial on Tuesday was 6,500 tons, and this mass was driven through the water at a speed greater than that attained by the largest of the iron frigates, with the exception of the "Warrior." Thus far, says the *Times*, then, the Admiralty may congratulate itself on the perfect success which has been obtained by the first of the squadron of iron-clads so far as its steaming qualities are concerned. At the termination of the runs at full speed, it was determined to try the vessel at half-boiler power, and four runs were accordingly made at the measured mile, with the following results:—In the first run the time was 6min. 45sec.; the speed in knots, 8·889; the number of revolutions of screw, 47; and the pressure of steam, 19; pitch of screw, 27ft. 6in. In the second run the time was 5min. 9sec.; the speed in knots, 11·650; the number of revolutions of screw, 49; and the pressure of steam, 20; pitch of screw, 27ft. 6in. In the third run the time was 6min. 29sec.; the speed in knots, 9·254; the number of revolutions of screw, 47; and the pressure of steam, 20; pitch of screw, 27ft. 6in. In the fourth run the time was 5min. 46sec; the speed in knots, 10·405; the number of revolutions of screw, 47; and the pressure of steam, 20; pitch of screw, 27ft. 6in. In all the runs the vacuum fore and aft was 24. The average speed of the four runs at half-boiler power was 10·140 knots. At the termination of the trials of speed some experiments were made in order to test the time in which the half-circle would be made. Four runs were accordingly made with the following results:—First run, helm put hard a-starboard, with four men at the wheel, and the rudder at an angle of 18 deg., half circle made in 2min. 29sec.; second run, helm at port, and rudder at 17 deg., half circle made in 2min. 34sec.; third run, helm at starboard, half circle made in 2min. 42 sec.; fourth run, helm at port, circle made in 2min. 39sec. At half-boiler power the helm was put hard a-starboard by four men with three turns of the wheel, and the rudder at an angle of 15½ deg., when the half circle was made in 3min. 40sec., the screw making 39 revolutions per minute, and the diameter of the circle 300 yards. The helm was then put hard a-port, at an angle of 14½ deg., and the half circle made in 3 min. 32sec. Commander Crewe-Read, who superintended the trials, then directed the helm to be put hard a-starboard to an angle of 18 deg., and the ship going at full speed, with the screw making 54 revolutions, the complete circle was made in

6min. 38sec., the diameter of the circle being a little more than double the vessel's length. During the trials, which were protracted until a late hour on Tuesday afternoon, the "Royal Oak" was found to answer her helm remarkably well, and was steered as easily and expeditiously as a river steamer.

The boilers generated a full supply of steam, and the engines worked with remarkable steadiness and precision, and with scarcely the slightest vibration. The average temperature of the stokeholes, with 24 furnaces at work, during the trials, was 78 deg., and the engine-room 62 deg.; this low temperature being attained by the admirable ventilating apparatus fitted on board the "Royal Oak," by the inventor, Mr. Baker, Chief Engineer of Chatham Dockyard. As a comparison, it may be mentioned that the average temperature of the upper deck was 58 deg., and that of the lower deck 64 deg.

IMPROVED BEARINGS OR STEPS.

MR. N. J. AMIES, of Manchester, has lately patented an invention designed for the purpose of dispensing with brass and other expensive metals employed in the manufacture of "steps" or "bearings," and it consists in the substitution and use of malleable cast iron for the exterior or case, and in filling the interior or parts subject to friction with any well-known non-metallic antifrictional composition, or with one consisting of caoutchouc, gutta percha, or other elastic gums incorporated with plumbago, steatite, or plastic, earthy, or metallic matters bound together atomically with vegetable or animal gums or size, and in such proportions as, when dry, to form a hard and solid filling for the aforesaid hollow case. This composition constitutes the second part of the invention, and may also be used for bearings by itself, the chief feature being the combination of the aforesaid ingredients or others equivalents to the entire exclusion of all vegetable or animal fibre, such composition exciting less friction, and consequently is better adapted for steps or bearings than when fibrous materials are combined therewith.

The bearings, journals, or steps are to be cast of malleable cast iron, and formed with cavities or recesses, for the filling of the aforesaid composition is to be opposed to the frictional surface requiring lubrication, and which may be made of caoutchouc, gutta percha, or other elastic gum, one part; plumbago, steatite, or plastic, earthy, or metallic matter, three parts; and vegetable or animal gum or size, one part; or such other component parts as may be found desirable; but when water or liquid in a heated state has to come into contact with the composition, the inventor prefers to employ a gum called "rhus copallinus" (gum copal) which is better calculated to resist the action of heated liquids. He also states that this composition may be employed alone, suitably cast or formed without the addition of wood or metal.

OXALIC ACID FROM SAWDUST.

AT a recent meeting of the Pharmaceutical Society of Great Britain, held in George-street Hall, Edinburgh, Dr. Murray Thomson, F.R.S.E., read a paper on Mr. Dale's new patent process for the manufacture of oxalic acid from sawdust, acted upon by alkali, lime, &c. Dr. Thomson illustrated his remarks by specimens and drawings, all of which were viewed with much interest by the meeting. It appeared from the statement in the paper that, by proper manipulation, 2 lb. of sawdust wére made to yield 1 lb. of oxalic acid; and that during one part of the process most of the alkali employed was recovered, and used again in succeeding manufactures. The produce in Mr. Dale's establishment was weekly about nine tons' weight—an amount more than half of the oxalic acid believed to be used all over the world. A vote of thanks was cordially awarded to Dr. Thomson for his communication.—Mr. John Mackay described and submitted various specimens of the new French carboniferous preparations about to be introduced to this country by Professors Pichot and Malapert, of Poitiers, for the purpose of disinfecting and dressing wounds, ulcers, &c. After several years' experience in France, the commission for inquiring into new medicines and remedies instituted by the General Administration for Public Assistance, as well as by the Military Council of Health at Paris, have decided that the preparations be approved of, and placed at the disposal of the surgeons of public institutions, both civil and military. The different forms are charpie, sachets, paper, and tissue. An agent having been appointed in London, there was now every facility for procuring the various forms, and they would therefore doubtless be soon practically tested by the medical authorities here.—Notices were given regarding the Prize Essay Committee and the library, after which the meeting terminated.

NEW MATERIALS FOR PAPER.

THE *Wellington Independent*, a New Zealand paper, writes:—"Complaints have been made in England of the want of material for making paper. Straw has been used for the purpose; but surely a much better paper could be made from our common flax and the leaves of the cabbage-tree (and quite as good, I should think, as that made of the old rags which have hitherto been used)? Flax can be had, as we all know, in any quantity; the cabbage-tree is not so abundant; but there need be no lack of this, for, when a tree is cut down to get at the leaves, if the stem is laid in a shallow trench, and slightly earthed up, a dozen young plants will speedily spring from it, and the leaves may be cut in the following year. That these plants (the flax and cabbage-tree) will afford good materials for making paper, I think there can be no doubt; but the question arises, what would be the best form in which to send then to England? This I cannot answer; but I think the subject well worth attention. Would not paper-mills in this country pay well?"

In a late Sydney newspaper, says the *Paper Trade Review*, mention is made of a peculiar vegetable substance, taken from the root of the *Zamia spiralis*, vulgarly known as the native palm. This plant, which flourishes luxuriantly over millions of acres of land in New South Wales and other Australian colonies, otherwise unproductive, seems to possess many properties which would render it highly valuable as a plant of commerce. The substance is a sort of cotton, very short in the staple, but fine and soft, and it would appear to be admirably adapted to the manufacture of paper. Experienced persons state that it would be preferable for this purpose to the refuse cotton of the manufactories of Lancashire, which is bought by the paper-makers at the rate of 6d. a pound. The specimen was collected at the Clyde River, near Bateman's Bay, and is described as forming a kind of external clothing to the fibrous roots of the plant.

The plant also produces a fine gum (resin ?) as pure as amber, which would, doubtless, be available for many purposes of commerce, although the gums exuding from the palm trees of New South Wales have hitherto been found too brittle for ordinary use. The seed of the plant is commonly used by the aboriginal natives as food, and may be readily manufactured into the finest starch and farina, the latter property of the plant having been well known and acted on by settlers in the district for some time past.

ON A NEW FORM OF SPECTROSCOPE.

BY DR. WOLCOTT GIBBS.

MESSRS. J. and W. GRUNOW, the well-known opticians of New York, have just completed, at my suggestion, a spectroscope involving a new principle, or rather one for the first time applied to instruments of this kind. In this instrument the prism of flint glass has a refracting angle of only 37 deg.; the rays which diverge from the slit are rendered parallel in the usual manner, by an achromatic lens having the slit in its principal focus. The bundle of rays then falls upon the first surface of the prism at a perpendicular incidence, and of course makes an angle of 37 deg. with the second surface. Under these circumstances, the refraction takes place at an angle so near the limiting angle that the refracted rays emerge nearly parallel to the second surface of the prism. The amount of dispersion produced in this manner is very great, while the loss of light, occasioned by reflexion at the first surface in the prisms of 60 deg. placed in the position of least deviation, is avoided. The spectrum thus produced possesses remarkable intensity, and the dark lines are seen in countless numbers and with great distinctness. The instrument in this form is sufficient for all chemical purposes; but it is so constructed as to permit the use of a second prism, by which the length of the spectrum is of course greatly increased. Though the telescopes are only six inches in length, with a magnifying power of about 6, the spectrum compares very advantageously with that of a large apparatus with telescopes of eighteen inches focal length and one and a half inch aperture, and a prism of 60 deg. I may mention that the centre of the second surface of the prism lies in the vertical axis of the instrument, and also that in a prism of this kind the refracted rays diverge as if from a single radiant point (which is not the case with prisms of the ordinary construction), the angular dispersion being at the same time much greater. So far as I have been able to find, this form of prism was first employed by Matthiessen. In a lithographed copy of Regnault's "Lectures on Optics" at the College de France in 1848, prisms on this principle, of various forms, are figured and described, together with the spectra produced. These last exhibit an extraordinary extension of the violet end of the spectrum. A Matthiessen prism of flint glass, in which the first surface is concave so as to admit the addition of a double convex lens of crown glass, appears to be preferable for the spectroscope, in consequence of the saving of light.—*Silliman's "American Journal,"* January, 1863.

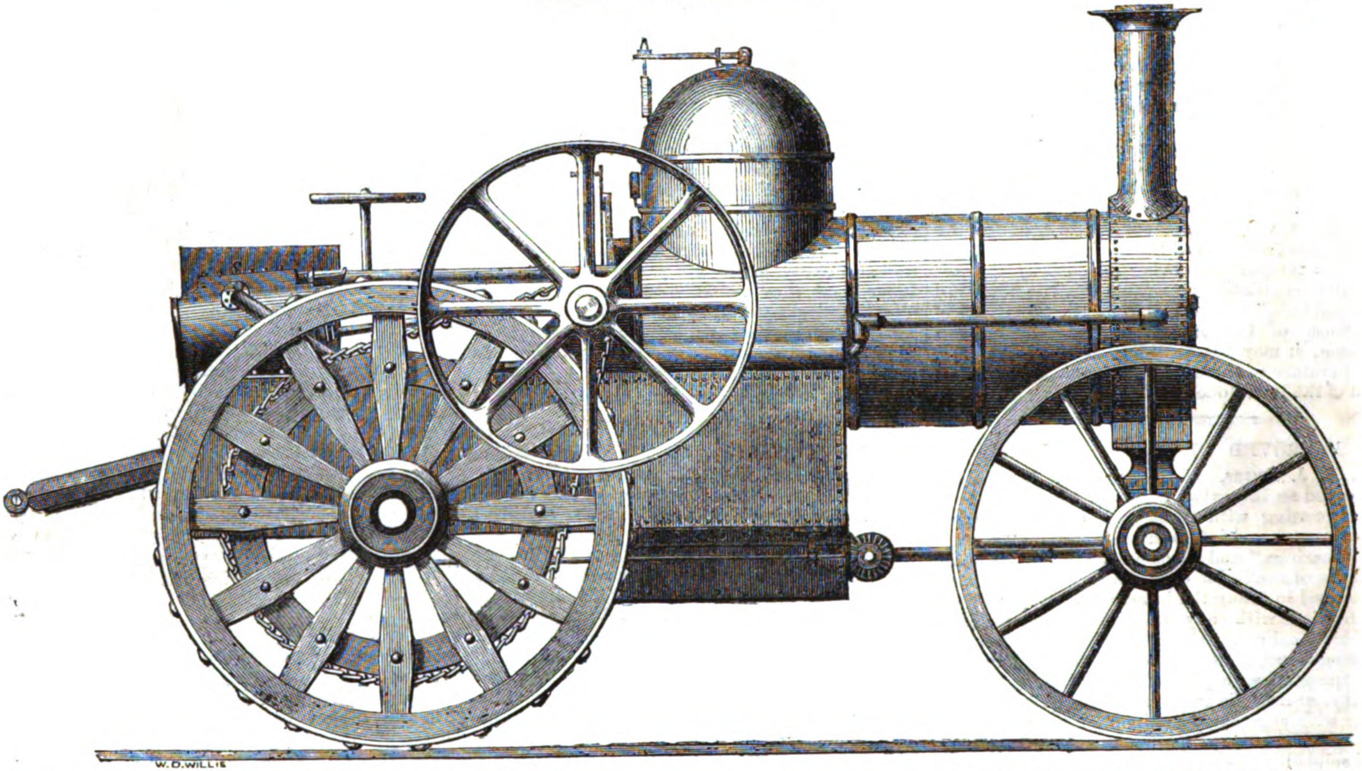
TREUILLE AND TRAXLER'S PAPER FOR DOCUMENTS.

THE experience of the paper manufacturer, says the *Paper Trade Review*, is always finding new modes and elaborating old methods for the improvement of his handicraft. There is constantly some new process discovered which puts the old into disuse, and makes the stability of our occupations impossible. The improvement to which we have now to call attention is, perhaps after all, more fanciful than of much practical utility, either to the manufacturer or to the public. Admitting even that it does not add greatly to the service of the public, we cannot but award it the highest praise for its ingenuity and skill. It is lamentably well known that our public documents of value and importance are often tampered with by the dishonest and fraudulent. This improvement is intended to reduce their chance of success to the smallest minimum. The paper made by this new process consists of a sheet made up of several layers of pulp laid over each other, of different qualities and colours, as may be required.

To hinder the falsification of documents, it is merely necessary to colour the pulp which forms the middle layer, with a colour which would be acted upon by the chemicals employed in cancelling the writing. The document would be thus injured, and it could not be again restored in colour while the surface remains white.

We will now proceed to detail the process of manufacture:—Three vats are employed. The first vat, which contains a weak solution of white pulp; the next vat contains hemp, or common-coloured pulp, requiring a stronger pulp than the first; the third vat contains a greater amount of white pulp. A layer of white pulp is first taken in with the mould; it is then dipped into the second vat to receive a second layer of coloured hemp; thereafter the third layer of white pulp is added. In order to prevent the first layers from breaking in the subsequent pro-

GILES'S TRACTION ENGINE.



cess, the mould should be lined with a piece of wire-work. The intermixing of the coloured pulp with the white is prevented by placing the mould, which has received the first layer, in a casing with a wire-work bottom, so as to prevent the parts which are not covered by the first layers from being brought in contact with the pulp in the next vat—the casing being intended to take in the pulp whereby to forward the coloured layer.

GILES' TRACTION ENGINE.

There is no doubt that one of the greatest impediments encountered in the use of the traction engine on common roads, consists in the difficulty of getting a sufficient grip on the ground. The following is a description of a traction engine, patented by Mr. Giles, of 69, Basinghall-street, and of the means he adopts in order to overcome the difficulty we have alluded to. The engine is four-wheeled, and is carried on springs; it has double cylinders, 6 in. diameter and 10 in. stroke. The traction engine is poetically called a "steam bull" by Mr. Giles. The improvements he claims consist in the embodiment of the principles of "animal tractive efficiency" in a locomotive engine, the motive power of which may be steam or any other suitable agency. Locomotive engines hitherto constructed by Mr. Giles for the purpose of applying these principles to locomotive traction, have had their power made available through the agency of two or more levers (jointed or otherwise), which, representing the legs of an animal, and furnished with extremities representing feet, operate alternately on the ground over which the engine travels, imitating the pedal motions of an animal. Now these improvements consist in a method by which the principles of pedal traction are rendered effective in a wheeled engine without the aid of the aforesaid propellors or levers. The chief feature consists in the embodiment of the principle of animal traction in conjunction with a constant rotary motion, and by which the periphery of one or more wheels is made to manifest, at its point of contact with the surface on which it travels, a tractive adhesion equal to and based upon the same principle as that of the foot of the quadruped when employed as a tractive agent. The following is the mode of obtaining the above result:—At each side of the engine or boiler is fixed a stud, pivot, or other similar apparatus upon which works a lever or flat bar. The stud is fixed at a point on the engine forward of the axis of the drawing wheel, and the lever or bar is in an inclined or slanting position passing backwards to the driving wheel, the axle of which passes through the other extremity of the lever, which is thus made to serve as a bearing. Between the driving axle and the engine is introduced a spring, for the purpose of rendering the movement of the engine easy and free from jolting. A similar arrangement may be made with two or more levers at each side of the engine similar to the above described.

The frame of the wheel is constructed of wood or of iron, or of both; it is furnished with a metal tyre, roughed or indented to facilitate adhesion to the surface over which it travels, and of sufficient width and diameter to promote easy locomotion on an impressible surface; the annular toothed circumference is of iron, or of other metal, and may be manufactured in one piece or in segments; the teeth may be placed on the inner or on the outer circumference; in the former case the driving spur is placed between the toothed rim and the axle of the driving wheel. A shackle chain is used to communicate rotation to the driving wheel; the teeth on the rim are suitably constructed for that purpose; this annular toothed wheel is firmly secured by bolts to the frame of the driving wheel.

The connecting lever or link is a wood or iron bar furnished with a bearing at each end, through one of which passes the axle of the driving wheel, while the other is secured to the spindle of the driving spur, keeping the two wheels in gear; its length is varied according to the distance between the axles of these two wheels. The driving spur is a small toothed wheel secured to the end of the spindle; it communicates motion to the driving wheel, either directly, or by the aid of a shackle chain. The spindle is provided with a clutch, so that it can be thrown in and out of gear with the motive power; this is to facilitate turning the engine, it being necessary in a short turn to liberate one wheel from the influence of the driving power. On each side of the engine is placed a slide, or guide, fixed to the frame of the engine, through which the connecting lever or link passes, the purpose of which is to keep the upper portion of the engine, when subjected to a side inclination from swaying on the axle, and to keep the bearings of the lever from any strain; the slide is of sufficient length to allow the lever an up and down play of at least six inches at that extremity which secures the axle of the driving wheel. A spring may be placed between the axle of the driving wheel and the weight of the engine, and is secured to the framework of the engine, but not necessarily to the axle, or *vice versa*. A shackle chain is used to give motion from the driving spur to the driving wheel when that is not effected by direct communication. A break wheel is keyed on to the spindle of the driving spur, to which pressure is applied by a break when the speed of the engine is to be checked; the spindle rotates in suitable bearings fixed to the framework of the engine.

CURTIS'S APPARATUS FOR ASCERTAINING FARES AND DISTANCES TRAVELLED BY VEHICLES.

The accompanying engravings illustrate an invention recently patented by Mr. W. J. Curtis, of Holloway, for an apparatus for ascertaining the fares and earnings of public vehicles. The invention relates to a novel mode of checking the receipts of and determining the fares of passengers in public conveyances. In adapting the invention to a cab or omnibus, the patentee provides a packet of cards having on their face a graduated dial, numbered and representing distances in miles, half miles, and quarter miles, if necessary. Each omnibus passenger or hirer of a cab will receive one of these cards on entering the vehicle, it having been pierced by a punch to indicate a starting point on the dial. On leaving the vehicle the card is to be again pierced, and the distance between the two nicks in the card will show the distance traversed. The punch will, however, when making the second nick, which indicates the termination of the passenger's journey, strike out a portion of the card, and discharge it into a receiver, which is accessible only to the proprietor of the vehicle. This punched-out portion will have a counterpart

CURTIS'S APPARATUS FOR ASCERTAINING FARES AND DISTANCES TRAVELLED BY VEHICLES.

FIG. 1.

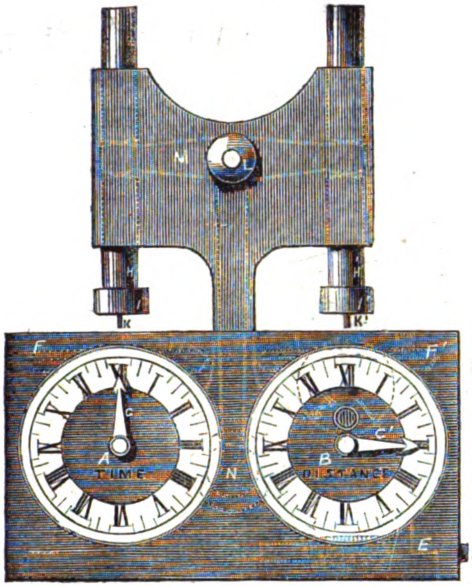


FIG. 2.

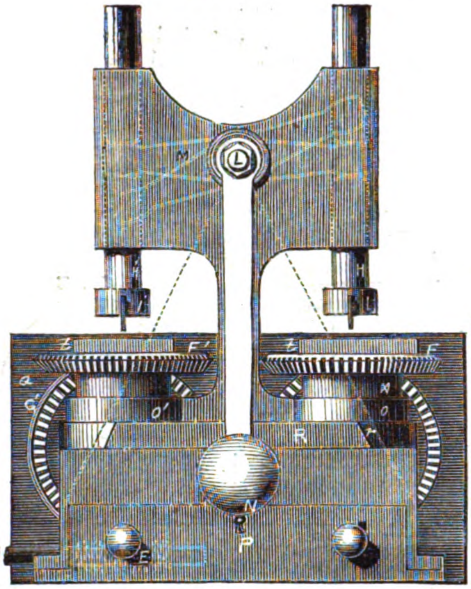
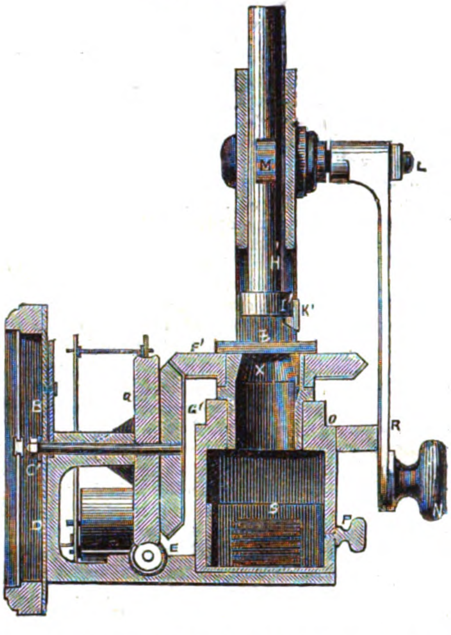


FIG. 3.



of the nicks retained by the passenger, and will, therefore, show the amount of the fare chargeable to the passenger. The manner in which this is attained is as follows:—A small rotating table is provided mounted on an open tube, and rotation is given to the table by means of a worm wheel and worm, the worm shaft being driven from one of the carrying wheels of the vehicle. The amount of axial motion the table will receive will therefore be relative to the distance run by the vehicle. If thus the relation be such that the graduated card when placed on the table would indicate by its rotation under a fixed point the distance run, it will be understood that the nicking of the card, as above explained, will give an accurate measurement of the distance travelled. The rotating table is fitted with a recess to receive the card in a given position, and above it is placed a cylindrical punch, fitted with a projecting knife blade. This punch is worked by a hand lever, and when forced down to give the first nick to the card a stop will prevent the punch from descending further than is requisite to bring the knife blade into operation. When the card is next applied to the rotating table, the duty of the omnibus conductor or cab driver will be first to draw back or otherwise prevent the action of the stop, and then to depress the lever. By this movement the punch will cut a second notch in the card, and then strike out the centre of the graduated dial, forcing it into the tubular receptacle below.

In some instances a rotating dial is mounted in the vehicle (with a fixed pointer) corresponding to that on the card. The dial in this instance is connected with the gearing which drives the rotating table, and thereby ensures a corresponding rotary motion between the dial and the table. The use of the rotating dial is to afford passengers a means of checking the marks on their card when entering and leaving the vehicle.

In vehicles hired by time the rotating table may be operated by clockwork, and the dial on the card to be pierced may represent a clock face. The distance between the nicks made on entering and leaving the vehicle will in this case show the time consumed in the journey.

Fig. 1 shows a front view; fig. 2, a back view; and fig. 3, a section in the line of the axis of the distance indicator.

A is the dial of the clock, the movement of which may be similar to an ordinary clock movement. On the axis of the fusee is fixed a mitre bevel wheel G, which gears into another mitre bevel wheel F, working loose on the upper part of the vertical bolster X fixed firmly vertically in the box O, O^1; H is a vertical punching machine, similar to those in common use for stamping paper, the piston being raised and depressed by the lever M and handle N. The punch K is connected with the lower part of the piston in the usual way, and the marker K, like a thin chisel or knife, is firmly connected with the punch. The dial bevel wheels and punch connected with the distance indicator are the same as those for the time or clock indicator just described, the movement being effected by means of the worm wheel Q worked by the worm E connected with one of the carriage wheels, the divisions on the distance dial showing the miles and parts of a mile travelled by the carriage, as the time dial shows the time occupied by the journey. Upon the axis of the worm wheel Q is a pinion working into a cog wheel five times its diameter, upon which divisions are formed and figured, shown by the dotted lines and figures behind the distance dial in fig. 1. As the figures pass the hole shown in the dial, the number of miles travelled in a day or any determinate time can be noted. The mitre wheels fixed upon the axles of the clock and distance dial hands gearing into the horizontal wheels F, F^1, the revolutions of the whole perfectly coincide, so that cards printed with a dial and kept in the horizontal wheels, the same numbers and divisions on the cards will point to a fixed point in the same way as the fixed numbers or divisions on the dials are pointed out by the moving hands or pointers C, C^1. The cards are kept accurately in their place by being dropped into the frame t, t^1, fixed on the back of the horizontal wheels, and one corner being cut off the cards will only fit in the right way, and no possible mistake can ever arise whether the distance or time side of the card be used, and by printing the cards no error can arise in working the machine. A drawer is placed under the punches to receive the centres of the cards cut out by the punches, which drawer being only accessible to the proprietor of the carriage the centres of the cards or vouchers cannot be tampered, with by the driver. A notch is left in the upper part of the fixed bolster in order to allow the markers K, K_1, to pass through the cards. On the face of the box a projection R is formed, against which the back of the handle N works, and stops r, r^1, are placed (as shown in fig. 2) to limit the movement of the handle, thus regulating the stroke of the punches when the card is to be marked by the chisel K, K^1, in the first instance; but when the longer stroke is required for the last operation to cut out the centre of the card, the driver pulls the handle forward by means of the nob N, when the handle will be sprung outwards, and caused to pass the stops r or r^1, and the stroke lengthened as may be required. D is the dial plate, both dials being shown upon one plate; they may be detached, if preferred.

The "modus operandi" is as follows:—The cards placed upon the horizontal wheels or tables F, F^1, turn round in the same time as the hands of the clock and distance indicator, and consequently any point of the dials pointed out by the hands corresponds with a like point under the chisel or knife of the punch, so that when a passenger enters the carriage, a card being placed in either of the frames t or t_1, and the handle N drawn right or left by the driver until it is stopped by the projection r or r^1, the chisel will cut through the card, thus marking the time or distance at starting, then when the journey is ended, a second punch being given by the chisel denotes the time occupied or distance travelled, thus denoting the fare payable by the passenger, but in the second operation the punch is made to give a longer stroke, so that the round part I or I^1 is made to punch out the centre of the card, which dropping into the drawer S of the box, and having upon its outer edge the cuts of the chisel, remains a voucher to the proprietor of the fare received and distance run by the carriage when the fare is determined by distance only. If it should be desirable to ascertain both time and distance, by nicking the card in the time frame and then turning the card upside down and nicking it in the distance frame at starting, when the journey is ended nicking the card in the distance frame and then nicking it in the time frame, one side of the card will show the distance travelled, and the other the time occupied in travelling. The passenger by inspecting the dials, or by taking the card upon starting, and handing it to be nicked by the driver when leaving the coach, can never suffer any imposition.

A person at Toronto has constructed india-rubber mailbags with the mouth compressed by screws, so that the bags are water-tight, and will float when full of letters and effectually preserve their contents. It is stated that they can be made at much less cost than the leather bags, and will stand far more wear and tear.

TRANSFORMING CIRCULAR MOVEMENTS.

MR. A. L. THIRION, a Roman Catholic clergyman, of Namur, Belgium, patented in England, in the year 1858, the following method of communicating circular motions:—

The invention consists in connecting the shafts of wheels to which motion is to be communicated, first, by means of a number of circles or rings cut through and connected together end to end, in such manner that the whole will form an elastic spiral, for the purpose of communicating motion from one shaft to another not in a line with the same. Or, instead of the aforesaid circles, a number of spirals are employed, formed of wire, folded one over the other so as to form but one. Secondly, by means of a number of circles or rings (the first of which is attached to the driving shaft) turning upon a curved or semicircular axis, the circles being connected to each other by bands in such a manner that when motion is imparted to the first circle, it actuates the second circle, and so on, through the whole number of circles employed when the motion is transformed to the desired wheel or shaft.

Fig. 1 represents an horizontal axis A, A, to which is attached the first circle of the spiral S, S. Motion being given to the axis A, A, it follows that all the circles composing the spiral turn at the same time, and communicate their motion to the axis B, B, and consequently to the wheel R, R. One half revolution being completed, that part of the spiral at S¹, S¹, will be found at S, S, and *vice versa*. Said spiral is made supple, whilst at the same time it should offer a certain amount of resistance. The necessary degree of suppleness or elasticity is obtained by means of flattened or sheet iron (fig. 3), and the amount of resistance obtained by giving to the circles cut out of sheet iron a certain width, as shown at L, L, fig. 3. The circles are uniformly cut according to the line L, L, and joined end to end, so as to form but one piece or spiral. A number of spirals formed of wire, rolled one over the other, so as to form but one, may be used. To prevent the circles spreading out unequally, they can be connected at certain intervals by bands or wires.

Fig. 2 represent several circles turning upon a curved or semicircular axis. The first circle actuates the second, to which it is attached by a band C, C; in like manner the second actuates the third, and so on until the last. It is not important that these circles should be entire, it being sufficient that they should turn in the axis.

ANTI-INCRUSTATION COMPOSITION.

THE incrustation of boilers is a matter just now engaging much attention, and the usual result shows itself in a multiplication of special patents.

Mr. Alexander Delrue, of Dunkirk, France, has taken out a patent for compositions to prevent and remove incrustations. The compositions are composed entirely of vegetable matters, and are prepared by dissolving or infusing in hot water the bark of the oak and pine as well as the leaves of the sumach tree ground and reduced to the state of a coarse powder; this decoction is concentrated to a density of about 10 deg. Beaumé, and to it is added a quantity (say from 15 to 30 per cent.) of cream of tartar (bitartrate of potassa) and spirit of turpentine. In employing this liquid to prevent incrustation in steam boilers, a quantity of it is introduced from time to time into the steam boilers, the quantity of the liquid required varies according to the capacity of the boiler, three pints of the liquid being generally sufficient for every thousand pints of water in the boiler to prevent incrustation forming for about ten days.

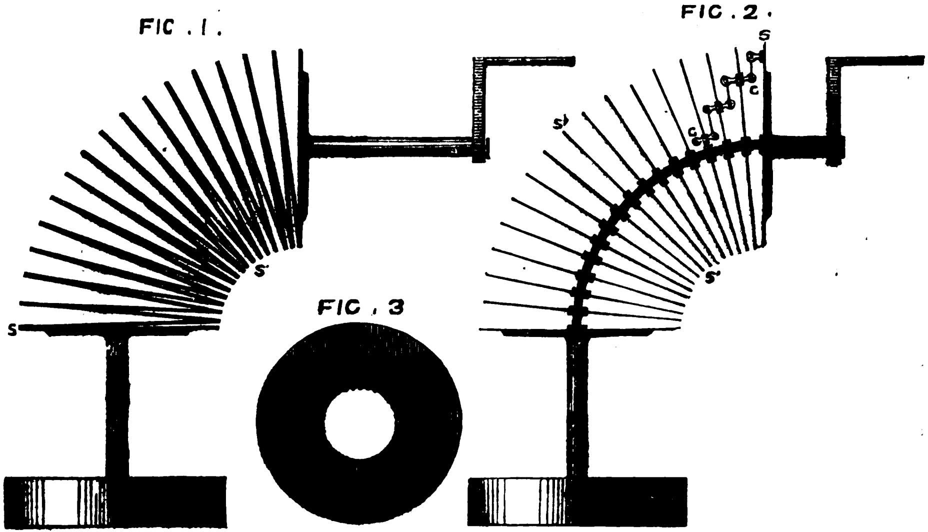
TO CORRESPONDENTS.

Correspondents who wish their manuscripts to be returned are requested to state this.

We beg our correspondents to choose initials, rather than general signatures such as "Constant Subscriber," or "Reader," &c.

A. S.—Glass gauge tubes may be cleaned by washing in dilute sulphuric acid, and then rinsing them in pure water.

THIRION'S COUPLINGS.



D. T.—"Molesworth's Pocket Book of Formulæ" would probably suit your purpose.

H. R. M. (Plymouth).—It is very probable that the cement would crack by the jar occasioned in nailing on the metal sheathing. It is also not unlikely that a solution of caoutchouc applied to the ship's skin, or to the back surface of the wood sheathing, would be of good effect; but it is impossible to pronounce an opinion upon questions that depend so much upon experimental conditions. The use of a solution of india-rubber would of course be very expensive. You will find an abstract of a paper read by Mr. John Grantham, "On the Hulls of Ships and Fouling of Ships," before a meeting of the United Service Institution in our numbers for Nov. 15th and Nov. 22nd, 1861, pages 328 and 341. In the second part of this paper, pages 341 and 342, you will find his peculiar plan of sheathing for ships fully described by the gentleman himself.

F. G. would do well to study the amenities which are generally recognized amongst journalists before he writes.

D. E. (SUBSCRIBER.)—The data you give are not sufficient to make a complete estimate; but, it is well known that *one* vertical saw blade of the description you are using consumes one *actual* or indicated horse power per hour in cutting at least 45 superficial feet of soft wood per hour. We do not know the amount of work you want to turn out, nor the state of the sawing apparatus, nor the distance from whence the power has to be conveyed, &c., &c., but three-horse power ought to be amply sufficient to do your work. If you hire the surplus power of some engine, you could exactly ascertain the power you consume by means of an indicator.

G. C. P. and J. B. B., whose communications on "Silicate of Potash" appeared in our numbers for February 27th, and January 2nd respectively, are begged to communicate with T. S., 7, Pear-street, Ecclesall-road, Sheffield.

W. F. (Tenby, South Wales).—Have you calculated the amount of horse-power required to propel an ordinary vessel at "a speed of thirty miles per hour"? We greatly fear that you are pursuing some ingenious "*ignis fatuus.*" It is difficult to advise an inventor as to the means of effectually bringing his scheme into notice, particularly, if, as you state, you have already shown it in the proper quarters. If you like to forward us a clear and concise drawing of your invention, and a similar description, we will publish it *pro bono publico*, on finding that it is meritorious and novel. We will return your communication if so desired.

T. G. C. (Bristol).—Your particular arrangement for "fastening the reins to the spoke of the hind wheel of a vehicle nearest the ground, to stop the animal by the strain on the bit," should he attempt to start in the absence of the driver, seems ingenious and novel, as far as we understand it. We would always advise the making of a sketch, in order to render any mechanical scheme completely intelligible. It is obvious, however, that such a plan would not be applicable to a spirited horse.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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AN ATLANTIC TELEGRAPH.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In my previous letter it was shown that, in the peculiar circumstances therein stated, it is now the duty of Her Majesty's Government to form the first telegraph from Britain to America. The question which it is proposed on this occasion to consider is, Where should the line be laid in the ocean—whether along the bottom, or near the surface?

To lay the cable along the bottom of an ocean reaching to more than two miles in depth, and of such great breadth—whichever route should be chosen—is most objectionable. The utmost uncertainty as to the suitability of the bottom for the cable; the thorough inaccessibility of the cable laid at such a depth for repair or otherwise; the enormous pressure of the superincumbent mass of water upon the cable, are most convincing reasons against laying the cable along the bottom of the Atlantic, if that course can possibly be avoided.

After reflecting on these evils and the means of their avoidance, I proposed, some two or three years ago, that a telegraph cable of slightly more specific gravity than salt water should be suspended near the surface by means of, say, five or six buoys, each placed at a due interval along the route from Britain to America, and so anchored as to approach within 20 or 30 fathoms of the surface, at or about which depth it is believed the cable and buoys would be out of the way of surface commotion of *every kind*. I also then showed that in the open ocean, at a distance of a few miles from land, there are no tidal or other currents, excepting surface currents caused by the wind, and which only prevail a few fathoms down. The cable, where it left and approached the land, would be adapted to and laid along the bottom of the sea,—as land is the real cause of, and is surrounded by, tidal and other currents, excepting in so far as currents are occasioned by the wind on the surface, as above-mentioned. By adopting this course, the nature of the bottom, except at the shore ends, would be a matter of no consequence; the cable would be quite accessible; the pressure of a great superincumbent mass of water, with all its evil consequences, would be avoided; and, in addition to all these advantages, the cable itself would be more cheaply constructed and easily laid in consequence of its lightness.

I am aware that these views as to the non-existence of *under* currents in the open ocean are opposed to Maury's views in his book "The Physical Geography of the Sea;" but that book, I feel bound to say, after much investigation and consideration, is, so far as such currents are concerned, a mere romance—full of groundless assumptions and false analogies—and utterly opposed to all sound scientific reasoning, as that can only proceed on a basis of direct positive fact. The analogical fallacy which seems to have originated, and which vitiates, all his views on the subject, is grounded on the idea that currents must prevail to as great an extent in the liquid ocean as in the gaseous atmosphere. But that is a complete *non sequitur*, as any one who has paid sufficient attention to these two different states of matter, and their action, must be aware.

Since this system of surface telegraphy was proposed, I have seen no reason to abandon or modify it. On the contrary, I have since come to the knowledge that Mr. Wartman, of Geneva, has established that pressure diminishes the conducting power of a copper—and, doubtless, also of every other kind of wire—a fact which renders the adoption of surface telegraphy all the more imperative, for the enormous pressure of water two miles deep, and along many hundreds of miles, and that constantly upon a telegraph cable, must be most pernicious, and fully accounts for the failure of the former Atlantic Cable.

"An Old Sailor" recently criticised Dr. Wallich's plan for ocean telegraphy, lately published in your columns, and which plan it humbly seems to me is only valuable in so far as it agrees with the proposition now submitted. His criticisms unfavourable on the points of difference appeared to me to be well founded. I would take it as a favour if he would also criticize the present proposition. But he must *not assume under* currents to exist in the open ocean at and beyond a distance of, say, forty or fifty miles from land, unless he actually knows that they do exist.

Groundless assumptions have always been the bane of science, and, consequently, of advancement. And I think it will be admitted, that if no such under currents exist, all the mechanical arrangements involved in the present proposition would be accomplished with comparative ease, and would work successfully. H. K.

Edinburgh, March 18, 1863.

THE FRANCE AND ALGIERS SUBMARINE CABLE.

Sir,—From the very deep interest which has always been felt for this cable; owing to its being the only really deep sea telegraph which has, up to the present time, been a lasting success, I have been induced to inquire very minutely into all the circumstances connected with its failure, in order that they may be fairly estimated and considered in future.

The cable was commenced, and successfully laid from Algiers as far as the Island of Minorca, in September, 1860, and worked it in connection with the Spanish lines until September, 1861, when the second section, to Port Vendrees in France, was completed, and joined up—the entire length requiring but four ordinary battery cells to work the constant day and night stream of messages, the receipts from which, even in the comparatively short time the cable has been at work, have more than repaid the capital expended upon it.

On the 25th of November, and again on the 13th of December last, there were very heavy gales in Algiers, accompanied by lightning; and two separate faults were reported to the French Telegraphic Administration, and greater battery power was used to try and work through. The paddle brig-of-war "Brandon" was detailed with M. Ailhand and his staff to try and repair it. Their first tests indicated the fault near Port Vendrees, where it was lifted and cut; but their tests then gave it near Minorca, where M. Ailhand again lifted the cable, and cut it, carrying the end of the Port Vendrees section into Minorca, and dropping the end of the Algiers section into the sea. Their further tests then gave the fault near *Algiers*, where the cable was underrun to a distance of 2¼ miles from the shore in 85 fathoms water, until they reached the main hemp and steel cable. After this the water deepened very rapidly, and they cut the cable, joined it up again and dropped it, as their appliances would not allow them to underrun further. The French Administration then applied to Messrs. Glass, Elliott, and Co., to allow that firm's steamer, the "Hawthorns," which was then in the Mediterranean, to proceed to their assistance; and on her arrival at Algiers on the 29th of January, Mr. Canning adopted the following course of proceedings, at the wish of M. Ailhand:—That the "Hawthorns" should go to Minorca to find and test the end of the Algiers section, and to pick up some cable there, and that the "Brandon" should go to Toulon for more cable, so that on their return to Algiers the "Hawthorns" would have sufficient cable on board to lay in a new piece should she reach the fault off that place.

The tests by Mr. de Santy from the Algiers end indicated that either a break in the cable, or else the copper was exposed at a short distance from the shore.

The "Hawthorns," when at Minorca, found the end of the Algiers section about 1¼ miles nearer the shore than the position pointed out by the "Brandon;" and the iron cable recovered which had been underrun by that vessel had evidently been handled very injudiciously, and not as a delicate submarine cable ought to be used. The tests from Minorca showed a second fault about 90 miles towards Algiers.

Returning to Algiers, the "Hawthorns" grappled the cable off there, underran it to the junction with the main cable, cut it, and commenced to pick up towards the first fault, but only 150 fathoms after the splice made by the "Brandon" had been lifted, when the end of the cable came up, without having shown the slightest indication of strain on the dynamometer, and being quite slack. Depth of water 85 fathoms, and soft blue mud bottom.

The end being carefully examined, the outer wires proved in very good preservation, and from their appearance had evidently been broken by the "Brandon" in making the previous splice, as they were drawn in—like a kink, and the cable had been dragged a long way to the eastward of the course in which it was originally laid.

As the soundings gave a depth of 260 fathoms only half a mile further out to sea, and as the weather at this season is very much against these operations, it was decided that the attempt to reach the fault for the present should be abandoned.

From the faults having shown themselves immediately after heavy gales with lightning, it is the general opinion that lightning has been the cause of failure in this cable, especially as there were no lightning conductors in circuit with the cable and land lines; as, even for the short time the cable was landed at Minorca in 1860, during a violent storm of lightning, the conductor, which at that time was fortunately in circuit, was fused, and had it not been for this safeguard, the cable would at that time have been seriously damaged or rendered useless.

Taking the whole circumstances into consideration, I am led to believe that, had the ordinary precautions—lightning conductors—which are used with almost every other cable, been in circuit, the Algiers cable would have been still successfully working; or when the faults were first shown, had a vessel, thoroughly fitted with the proper appliances for these operations, been sent out, the first fault off Algiers could, we think, have been cut out, and it would then have been more than possible with the usual battery power to work through the second fault, and we should not now have to announce the loss of what we hoped was a really lasting deep sea telegraph.

The cable that has been picked up is in an excellent state of preservation, and is nearly covered with marine incrustations. The section of cable from Minorca to Port Vendrees is still in good working order, but it is commercially useless so long as the Algiers section is silent.

T.

Algiers, March, 1863.

AN ATLANTIC CABLE.

Sir,—Considerable despondency manifests itself up and down the country because of the slow progress made towards establishing electrical communication between Great Britain and America by means of an Atlantic cable, and the opinion is very prevalent that this desirable result can never be brought about by any public company unassisted by Government, or unless the executive take the work entirely into their own hands, and debit the revenue of the country with an extra half million for that purpose. This feeling is very natural, and it is useless to ignore its existence. The project of a second Atlantic cable *has not* met that hearty response which some people calculated on, and which, at first sight, one would feel bound to say it merits. There is unquestionably an indisposition on the part of capitalists to embark in the enterprize which is by no means agreeable to the over-sanguine; but it is worth while to investigate the cause of this. It may be attributed principally to two causes, one of which, however, would be comparitively inoperative were it not for the other. First, there is the disastrous failure of the old cable, and, secondly, the position assumed by the Atlantic Telegraph Company as at present constituted. With respect to the first consideration, ruinous and disheartening as the failure was, it yet practically demonstrated that the thing was feasible, and proved beyond question that what was then attempted, not altogether without success, would, at no distant date, be an accomplished fact. So that, in reality, it may be almost assumed that the element of confident hope preponderated, and, consequently, the opposite element, whereby the work was so lamentably retarded, was to be deemed only temporary. Of course it would be going too far to say that this feeling had become innocuous, but it was fast dying out, and would ere this have been ineffectual in hindering a renewed attempt, were it not for the anomalous characteristics of the Board of Directors of the Company now in process of formation, and which we have to consider as the second and principal cause why men of standing look shy at the concern.

It is, to say the least, an unjustifiable anomaly for any company to issue a prospectus soliciting capitalists to take up shares without condescending to say of what the bill of fare will consist. The Atlantic Telegraph Company should have been prepared with full particulars as to the description of cable they proposed to lay at the onset, and thereby have secured that implicit trust and confidence which is necessary should exist: every man interested in the scheme would then have been able to decide for himself as to the prudence of making an investment by taking up shares in the company, inasmuch as it would enable him to judge if the cable proposed was, or was not, in accordance with the teachings of electrical and telegraphic science; and if not in accordance therewith, there would still have been the chance left, on the one hand, to stipulate that the cable should combine in its construction the results of acquired experience up to this time, taking for its basis the conclusions of the Government Commission; and, on the other hand, the Atlantic Board could have descended from their pedestal without loss of dignity, and with perfect ingenuousness, to meet the requirements of the case as dictated by common sense, common experience, and the common interests of both. But the Atlantic Company have failed to do this; and I can, therefore, only repeat that their position is anomalous; nor have their subsequent proceedings been reassuring; how then can we wonder that they have not received that support which sanguine, but superficial observers, think they should have received? In lieu of what they should have performed, what have they done? The discordant elements which make up their scientific consulting committee will not beget the confidence that is wanting. Here are doctors of first-class eminence, and professors of world-wide celebrity, appointed to sit in conclave upon—a difficult problem, as some would make out, but which in reality is—almost the simplest matter under the sun, and quite within the range of the most ordinary electrician or telegraphic engineer. Seeing that the problem is already solved, and simply requires its fundamental points to be acted upon in all their entirety; in saying thus much, I neither undervalue the importance of cable construction, nor do I depreciate the deserved popularity and just eminence of men of whom this country and this age may be justly proud. But what has this committee done during the months that have elapsed since they were appointed? No conclusion has as yet been come to, and things remain in *statu quo*, and are likely to remain so for who shall say how long?—for are not these men, with all their celebrity, influenced some this way, some that, by motives which comport not with their dignity, nor the side they individually show to the world, nor yet the gravity of the subject they have in hand? I might here pause to inquire for what purpose was the committee appointed? Were its members really chosen that by their deliberations a first-class cable should be secured?—if so, they have had ample time, the task being not much more difficult than a simple sum in simple addition. Or rather was not their appointment a ruse, a make-believe, a promise of fine things to come—in short, a substitution of a sham for the reality?—if so, the cash might be got together in that way, without the directors being under the disagreeable necessity of binding themselves to any course in their choice of a cable which should run counter to their prejudices and, what is more, their interests. The opinion and counsel of such men as constitute this committee should be invaluable, and doubtless is, if taken individually, and proper discrimination were observed in comparing, sifting, and applying the same; but they occupy a wrong position for all that; or rather, perhaps, it is a position which should have been held prior to any prospectus being issued; and instead of having to announce the appointment of such a committee, the Atlantic Board should long since have had to record the result of its cogitations by giving a minutely detailed description of the cable recommended by the eminent conclave. And now there is but one thing that as wise men they can do, and that is to decide forthwith upon the style of cable they mean to adopt, and let the public judge if it be worthy of their support or not. So long as this matter is kept in the background, what proof have we that there will not be a repetition of some of the old blunders—that the results of the Government Commission will not be utterly ignored, as well as subsequent advances upon that, seeing that there is a large monopolized element mixed up with this body which is inimical to success, or at all events inimical to the manufacture of a cable commensurate with the requirements of the case and made in conformity with the advancement of telegraphic science. There are other minor causes which might be adduced, each contributing its quota to bring things to a dead-lock; these will readily suggest themselves to the reader whose perusal has kept pace with what has already been written upon the subject. But there is one we may just glance at. The securing of a proper cable is, of course, of paramount importance, and is a matter of the greatest moment; the submergence of that cable is only second in importance, and is a point upon which too much attention can scarcely be bestowed; and yet we have no intimation whatever from the directors of this company that they have taken any steps to secure a more efficient method of submersion than the wretchedly ineffective mode hitherto pursued, and according to no mean authorities is simply submitting the cable to a vigorous martyrdom, of itself sufficient to render useless the best cable ever manufactured. The organs of the Atlantic Company do not forget to boast of the eminent men of science called into its councils; but how is it that the nautical element is excluded? This latter, is, if anything, of more importance than the former. The manufacture of a good cable—thanks to the Government report and other means of enlightenment—is now a tolerably simple matter, although electricians would fain make it appear as complicated as a simple question of right and wrong after it has filtered through lawyers' brains, barristers' wigs, and courts of law; not so the submergence of a cable; this is a point little understood, and no intelligible and rational method of submersion will ever be hit upon that does not emanate from a seaman; then why are experienced seamen excluded from the councils of the Atlantic Telegraph Company, since no man incapable of managing a vessel in fair weather and foul ought to be entrusted with the laying of a cable? Is this flagrant omission likely to contribute to the confidence that is lacking? They who are careless to secure confidence by obviously right and legitimate means, ought not to possess it; and the case before us is a proof that they do not.

It cannot be gainsaid that, with the exception of an abundance of words to puff the thing into notoriety, nothing whatever has been done to confirm the vague and unsatisfactory promises made. The result is an indisposition on the part of capitalists to make up the sum required ere the allotment of shares can take place. But the Board of Directors have the power in their own hands to partially restore this want of confidence if they will only adopt a course opposed to that hitherto pursued, and manifest by deed as well as word that they are desirous of securing a good cable, made of the best quality of the most efficient materials, and by those whose specimens experiment has proved to be unexceptionable; that they from henceforth forego antiquated prejudices and petty interests, and abjure utterly all alliance with monopoly and every other noxious influence; that they will not entrust men inexperienced in, and innocent of, the smell of salt water to lay their cable when made by means of the barbarous expedients for submersion used hitherto; but will esteem experienced nautical men as indispensable to their councils, as giants in electrical science are in other respects. But failing to do this, things stand an excellent chance of remaining just where they are, nor can we regret that they should continue so, looking at the matter calmly and dispassionately. It is simply a choice between two evils: for affairs to continue as they are is the lesser evil, as the only other alternative is a certain risk of inefficiency, if not failure—by no means a desirable consummation to those true lovers of progress who desire not the prostration for perhaps another half century of submarine telegraph enterprise.

PHILO.

Meetings for the Week.

MON.—*Inventors' Inst.*—"On Inventions for Obtaining Aerated Fresh Water from Sea Water," by Dr. Normandy, at 8.30 p.m.
London Inst.—"On Music," by Josiah Pittman, Esq., at 7 p.m.
Medical, at 8.30 p.m.

TUES.—*Inst. Civil Engineers.*—"On Structures in the Sea; with a Description of the new Albert Harbours, Greenock," by Daniel Miller, Esq., at 8 p.m.

THURS.—*Linnæan Society*, at 8 p.m.
Chemical, at 8 p.m.

Gossip.

One of the largest merchant vessels ever borne upon the waters of the Tyne was launched on Saturday last, from the extensive iron-shipbuilding yard of Messrs. C. and C. M. Palmer, Jarrow. This vessel, the "Georgia," is the first ship of the three ships that has been completed; the others are in a state of forwardness. We understand it is the intention of Messrs. Palmer to launch the last of the three during the visit of the British Association to Newcastle. The "Georgia" is of the enormous burthen of 3,000 tons. She is capable of stowing 8,000 bales of cotton, and it is calculated that when fully loaded she will not draw more than 17 ft. of water, so as to suit the depth of water on the bar of the Mississippi. She is marked, however, up to as many as 24 ft. on the stern. Her length is 325 ft., beam 41 ft. We may mention here that the firm are under contract to build seven vessels, each of them 30 ft. longer than the "Georgia." She has a splendid full poop and top-gallant forecastle: the former is 90 ft. long, and the latter 50 ft. She is fitted up to carry 70 saloon and 200 second-class passengers. The saloon will be handsomely fitted up. She will carry a crew of 120 persons of all classes. She is roomy between decks, and the depth of hold is 30 ft. She will be fitted with a screw. Her engines will be nominally 300-horse power, constructed on the surface condensing principle, and fitted with feed heaters for the feed water and superheaters for the steam. Her engines when fully working will indicate about 1,200-horse power, and it is calculated they will propel the vessel at the rate of 10½ knots an hour. The boilers were designed and constructed under the immediate superintendence of Mr. F. C. Marshall, manager of the engine department of the works. She is fitted with a lifting screw, so that she may proceed without impediment when under sail alone. This vessel, together with her machinery, has been constructed under the inspection of Mr. John Jordan, surveyor for the Liverpool Underwriters' Association. This association has been commenced with a view of classing such ships at a higher rate than heretofore, so as to fully recognize the qualities of iron ships. The "Georgia" will be classed 22 years A 1.

H. Roper, of Roxbury, Mass., has invented and completed a steam carriage, which, according to report, subserves the ends for which it was made. A recent trial of this innovation upon the "old style" was very successful; it passed through Boston, and, meeting a car on the horse-railroad, turned off the track, and went around the car, with as much ease as if drawn by a horse. On a smooth road or on the rail, with sixty pounds of steam (the usual amount), the carriage can be run at the rate of twenty miles per hour. The weight of the carriage is 650 pounds.

A prospectus has been issued of the Patent Ventilating Granary Company. The object is to work certain patents granted to Mr. A. Devaux, in 1856, for improvements in the construction and fittings of granaries, and the board of direction comprises several representatives of firms largely connected with the corn trade.

Letters from the Upper Canada oil springs state that a well, which some time since ceased to flow, has again commenced spouting, and now yields from 300 to 400 barrels a day. A large quantity of oil is also being taken from the different wells by pumping; so there is no fear of any present failure of the supply. The inhabitants of the oil district are about to sink what istermed a "test well," in order to ascertain what quantity may be expected to flow from a greater depth than yet reached. It is intended to sink this "test well" 1,000ft., as none of the present wells exceed 300ft., in depth.

A correspondent of the *Engineer* says the great bridge over the Niemen, at Kowno, on the branch of the Great Russian Railway from Vilna to the Prussian frontier, has not attracted in England the attention which it deserves. This fine structure has a space of 129 sajenes or 903 ft. between the abutments, and there are besides two supplementary spans of 5 sajenes each, to assure the communications on the two shores of the river. The bridge is composed of four principal spans, resting on three intermediate piers and two abutment piers. The piers are formed of strong cast-iron tubes 8½ ft. in diameter in the interior, and sunk in the bed of the river by means of atmospheric apparatus to a depth of 5 sajenes or 35 ft. The sinking of these tubes was commenced in 1860, and they were completed in time to receive the girders, which were hoisted to their place with much pains and difficulty, but happily with great success. The structure was finally completed and made available for traffic March 1, 1862. At least 100 iron bridges must have been erected on the 1,010 miles of railway which compose the Great Russian system; but none of them approach in importance the great work over the Niemen, which was crossed fifty years previously in a very different fashion by Napoleon I.

An attempt made at Portsmouth to coat the armour-plates and their bolts with zinc by a French patented alkaline process has failed. A proposition has, however, now been laid before the Admiralty by a Mr. Walenn, a London chemist, to coat iron of any size, from a ship's bottom itself as one whole to a single bolt for the armour-plate, extent of material or shape being no objection, with a deposit of metal, such as brass or any other alloy, as thin as thick in substance as may be wished, with a bright, hard, enamelled surface. It would be at once seen that this would supply what is chiefly wanted—the means of preventing the oxidation of ships' armour and bolts and the fouling of iron ships' bottoms. Mr. Walenn has been directed to proceed to Portsmouth Dockyard to inspect the existing arrangements of baths and batteries now adopted there, and to send in to the Admiralty a special report, with accompanying estimates of his proposed plan of electrotyping.

In our last work on machine belting, we omitted to notice that Messrs. J. Moulton and Co., of Bradford, Wilts, were the oldest manufacturers of machine belting in the kingdom, and that they were the first to make belting on the American plan in this country.

The Admiralty have made the necessary arrangements with Captain C. P. Coles, R.N., for the construction of a seagoing shield ship, according to his plans, the aid of a professional draughtsman being accorded to Captain Coles by the Admiralty to assist him in carrying out his ideas. The central gun battery, shield, or turret principle has hitherto lain under a cloud to a certain degree, owing to the impression which had been widely disseminated that such a vessel could, under no circumstances, be equal to a broadside gun ship as a seagoing vessel for long cruises—say to the Pacific or China. Captain Coles has, however, always asserted the contrary, and has maintained that iron ships constructed and armed on his plan were not only better fighting ships than any broadside gun ships, whether of wood or iron, but that they would also be better sea boats under all circumstances of wind and weather.

A recent correspondent of the *Scientific American* contains a rather extraordinary suggestion for defending harbours. "I herewith, he says, give you an idea which may or may not be practicable; of this I leave you to judge:—Supposing the entrance into a harbour to be narrow, and a good fort or other stronghold to be in the neighbourhood, with a convenient place for a steam engine; from this lay down pipes of from three to six inches in diameter, directly across the channel where the vessels have to pass; the pipes are provided with several valves, so that no water can enter them. When required, fill the pipes with native distilled *coal oil* or other hydrocarbon liquids; then apply a force pump at the end nearest to the fort and force through the pipes a continued stream of oil, which, by the pressure, opens the valves and discharges the liquid oil. This oil being lighter than the water floats to the top, and can then be set on fire, either by Congreve rockets thrown from the land or by a preparation which, together with the oil, is forced through the pipes and would ignite when coming in contact with the air. There may be also forced through the pipes a quantity of small explosive shells which would do some service. The ignited oil will not only set the combustible parts of the ship on fire but will create such a dense and unpleasant smoke as to blind and suffocate officers and crews on board the vessels. I have been once in the midst of the fire and smoke of burning petroleum; and therefore I know that any one who has once experienced its horrors will never wish to be surrounded by it a second time."

At a conference held some days ago of those interested in Belgian railways, it was resolved that a gold medal of the value of 400f. (£16) should be given to the author of the best essay as to the means to be adopted for the improvement of traffic on the lines in this country, more particularly as to the manner in which the reciprocal obligations of the proprietors of railways, and of those who make use of that mode of conveyance either as passengers or as the forwarders and receivers of goods, should be most justly fulfilled; also as to the proper relative proportions of receipts and expenditure in the working of railways; and, finally, as to the influence which the rate of charge has on the conveyance of goods by rail in Belgium, both as to the length of the journey and the system of tariff that should be preferred. The essays must be sent to the office of the Railway Conference, 15, Galerie du Roi, in this city, before the 1st of May; and as they may be written in French, Flemish, English, or German, and all the statistical returns of the different lines will be placed at the disposal of intending authors, it is expected that there will be many competitors, so that much valuable information will be obtained, which may be turned to good account in the future management of railways in this country. It must also be admitted that, though it may be a check, it is by no means a fair way of obtaining useful hints from many who are well qualified to give them.

Uninflammable Stuffs.—On this important subject the French Academy of Sciences has received a report from MM. Payen, Velpeau, and Rayer, in which M. A. Chevalier's paper, sent in to the Academy on the 25th of January last, is discussed. From this report it appears that only three salts have hitherto been found that may be successfully applied to the purpose in question—viz., that of preventing ladies' dresses from catching fire. There are many other salts that would do the same, but not without spoiling the dye, or the gloss, or the texture of the stuff, &c. Of the three in question, the sulphate and phosphate of ammonia have the inconvenience of being decomposed by the heat of a smoothing-iron; but they are applicable in those manufactures where stuffs are stiffened by the action of hot air or cylinders heated by steam. They exercise no action upon either the thread or the colour of the stuff. The phosphate of ammonia may be mixed with half its weight of hydrochlorate of ammonia. To obtain an efficacious solution, 20 per cent. of this mixture must be dissolved in water. A solution of 7 per cent. of sulphate of ammonia produces the same effect, and is therefore the most economical salt that the trade can employ. But in those cases in which the smoothing-iron cannot be dispensed with, as in linen, for instance, a solution of 20 per cent. of tungstate of soda should be preferred. To obtain the desired effect, all these solutions must be applied to the stuffs after they have been stiffened and dried, because starch is always used in a weaker solution than that required for these salts. Acid tungstates destroy the thread of cotton stuffs, like borax, alum, and other substances previously recommended. The tungstate of soda is prepared in Cornwall, where the tin mines yield a large quantity of wolfram. It costs from £12 to £18 per ton, or about 4f. per kilogramme. The sulphate of ammonia costs about £14 per ton; it is produced in gasworks, and has hitherto been used for manure. —*Galignani.*

Gun Shield and Great Gun Experiments at Shoeburyness.—Want of space compelled us to omit in our last impression the concluding portion of our report of these interesting experiments. As it relates especially to the armour of land forts, an object no less important than that of iron-clad ships, we supply the omission, and recommend the observations which follow to the consideration of public men who are devoting their attention to the great question of our national defences. It remains for us to give some account of the state of the gun-shield after the tremendous battering it underwent. Nothing but the weight and mass of the iron plates and bars of which it is composed, sustained by a strut at each end of prodigious strength, kept it standing. At some parts a triple casing of iron made an aggregate of 18 in. in thickness, which was in no part less than 12 in. The principle relied upon was solidity and weight of the parts separately and collectively. But no mechanical means were employed to connect the parts securely and strongly to each other. There was no cohesive strength in the whole. The plates and bars were piled and crossed one over the other, and pinned together with 3-inch through-bolts. This mode of fastening rendered it impossible to draw the plates up taut to a bearing, so that between the layers of plates there were intervals which, however minute, were sufficient to render excessive vibration inevitable. To this defect of structure we believe the cracking of the plates is to be attributed. The real damage to the shield may be described by one word "dislocation." The parts separated from want of cohesive force, which cannot be obtained in such a material as iron by planks overlaying each other, no matter what may be their thickness. Engineers do not trust to iron planks as railway-bridge girders. They construct girders with plates and angle bars rivetted together, producing perfect cohesion of parts, and presenting the maximum resistance of iron edgeways to the tensile strain. We are disposed to think the same principle is applicable to the construction of iron gun-shields and the sides of iron-cased ships. The real strength of this experimental iron fort is in the struts, which are made on the iron-bridge principle. From the result of Tuesday's experiments, showing the resistance of plates to penetration when backed with iron, if rivetted fastenings be applied to the entire framework, and the plates be held securely to an iron backing, we believe the defence will be too strong for the attack, and that iron armour may be made literally invulnerable. An interesting question, the fastening of armour plates, has had some light thrown upon it by the ingenious contrivances introduced in his gun-shield by Captain Inglis, for the purpose of putting the elastic and rigid systems to the test. Four plans for securing the bolts were adopted, by varying the material of the washers to the screw-bolts. Some were india rubber, some lead, some woven wire, some iron, and some were rivetted. The last two represented the rigid—the former the elastic principle. Altogether, during the experiment six or seven screw-bolts were broken; of these all but two were provided with elastic or yielding washers, and not one rivetted bolt was broken. We are far from maintaining that these results determine the question, but they are indications for other trials, and the public are much indebted to the Iron Plate Committee and Captain Inglis for the careful attention they have directed to the most perplexing branch of a most perplexing question.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2405.
Boilers and Furnaces, 2386, 2397, 2408.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2378, 2401, 2402, 2401.
Ships and Boats, including their fittings—*none.*
Cultivation of the Soil, including agricultural implements and machines—*none.*
Food and Beverages, including apparatus for preparing food for men and animals, 2374.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2367, 2370, 2371, 2372, 2375, 2389, 2399, 2406, 2415, 2417, 2418, 2419.
Buildings and Building Materials, 2413.
Lighting, Heating, and Ventilating, 2379, 2380, 2385, 2390, 2393, 2424.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2376, 2381, 2384, 2392, 2398, 2407, 2416, 2420, 2422.
Metals, including apparatus for their manufacture, 2366, 2400, 2410, 2425.
Chemistry and Photography, 2373, 2414, 2426.
Electrical Apparatus—*none.*
Warfare, 2377, 2395.
Letter-Press Printing—*none.*
Miscellaneous, 2368, 2369, 2382, 2383, 2387, 2388, 2391, 2394, 2396, 2403.

2366. T. Richardson and R. Allanson. *Improvements in the manufacture or treatment of articles of steel, and in the apparatus employed therein.* Dated August 26, 1862.

In order to obviate various well-known difficulties, the inventors employ retorts or closed heating apparatus, and they prefer such an arrangement as will allow of the introduction and withdrawing of the steel, or the articles of steel into and from such retorts or heating arrangements, without their being subjected to a similar decarbonizing action of the atmosphere, and also that each retort or other suitable heating arrangement shall be so constructed as that a desired uniform temperature may be maintained. *Patent abandoned.*

2367. L. Jarosson. *Improvements in machinery for bleaching or washing textile fabrics and materials.* Dated August 26, 1862.

This invention consists in bleaching or washing textile fabrics or materials by means of dry steam and machinery of the following construction:—To a suitable framing the inventor connects a series of rollers, over and about which the fabrics are passed. The lowermost rollers are placed in a pan or trough containing alkali, caustic soda, or carbonate of soda. The several rollers being set in motion, the fabrics are drawn from one roller and pass through the solution in the pan or trough, thence they pass upwards between pressure rollers, and, finally, to a winding-on roller. *Patent abandoned.*

2368. J. Rider. *Improvements in the construction of fencing posts or standards, to be used either for straining or otherwise sustaining fences.* Dated August 26, 1862.

In making such posts, poles, standards, or pillars, the inventor mostly uses sheet iron, or other thin plate, and he constructs them in section of a diamond, square, or other straight-sided figure, whereby he obtains considerable strength; also he sometimes constructs such posts, poles, standards, or pillars of triangular section, or of serrated or indented section (as fully delineated in the drawings). In making the joints of these posts, standards, or pillars, he prefers to use a lap joint, and after hammering or rolling the sheet iron or other thin plate to the form required, to close the lap joint by soldering, galvanizing, rivetting, or any two or more of these means; but he does not restrict himself to the use of lap joints. The improvements also consist in bushing the holes in such posts, pillars, or standards through which strained fence wire passes; such bushing may be carried into effect by using for the sheet iron thin plate or other piping or tubing secured in the said posts, pillars, or standards. *Patent abandoned.*

2369. A. V. Newton. *A novel construction of instrument applicable to the cleaning of windows.* (A communication.) Dated August 26, 1862.

Provisional protection has not been allowed for this invention.

2370. A. Crichton. *Improvements in looms for weaving ornamental fabrics.* Dated August 27, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2371. G. Davies. *A machine for singeing woven fabrics of cotton, wool, or silk, by means of gas or alcohol.* (A communication.) Dated August 27, 1862.

This machine is constructed in the following manner:—The main framing supports, in suitable bearings, several carrying rollers and a pair of drawing rollers, by means of which the fabric to be singed is drawn through the machine. The frame also supports two pairs of revolving iron tension bars or rollers, so arranged parallel to each other in a horizontal direction, and supported in bearings so constructed, that each pair of rollers can be set nearer together or further apart, as required. Below each pair of rollers is a gas pipe, furnished with a row of burners, so placed that the flame issuing therefrom in a vertical direction passes between the pair of revolving tension bars or rollers, and singes the fabric passing round each of them simultaneously, so that each row of flame singes the fabric twice at one operation. Over the machine is an exhaust fan or ventilator, the pipe from which is furnished with two branches, having longitudinally openings immediately over each pair of rollers, the draught from which strengthens and steadies the flame, and at the same time carries off the down or dust produced by the singeing process. The gas pipes are mounted on cross bars at each end, so arranged as to be capable of being raised or lowered so as to raise or lower the flame as required. The machine is also provided with brushes either fixed or revolving to raise the pile at the moment of singeing. *Patent completed.*

2372. H. Harren. *Improvements in the manufacture of paper, and other productions in which fibrous material is employed.* Dated August 27, 1862.

In carrying out this invention, the inventor uses seaweed or other aquatic vegetable production, cleanses the same in fresh water, and steeps it in naphtha or spirits of wine, or in a mixture of either of them and water, or in chlorine, or in any gas, or liquid, or composition possessing the requisite bleaching properties. When sufficiently prepared he reduces the material into pulp by the usual or best known process. *Patent abandoned.*

2373. J. A. Coffey. *Improvements in the manufacture of salts of ammonia and other products from the ammoniacal liquors of gas works and animal charcoal works.* Dated August 27, 1862.

The apparatus for carrying out this invention is not described apart from the drawings. *Patent completed.*

2374. R. Sims. *Improvements in machinery or apparatus for pulping, stripping, or slicing turnips and other vegetable substances.* Dated August 27, 1862.

This invention relates to improvements in machinery for cutting, stripping, or pulping turnips or other bulbous roots for the use of animals, and consists in the use of a revolving double cone for hand or other power, having teeth or knives formed upon or fixed to its internal or external slant sides, and in the peculiar arrangement of the parts therewith connected. *Patent completed.*

2375. W. H. Turner. *Improvements in machinery or apparatus for carding cotton and other fibrous materials.* Dated August 27, 1862.

This invention is carried out in the following manner:—First, the patentee places under the "licker-in cylinder" of the carding engine a number of grate bars of varied angular shapes. The tops of the bars are formed so that when in their places they appear like the teeth of a circular saw inverted, but having spaces between them which gradually widen towards the bottom. At varied intervals the bars are formed of different angles. The front surface of the first bar is placed at an angle much more acute than if it radiated to the centre of the "licker-in cylinder," in order to give effectual resistance to the dirt and refuse contained in the cotton or other fibrous material, and the front sides of the other bars are placed at such varied angles as to afford a similar or gradually decreasing resistance, by which means the dirt is precipitated below, while the material passes forward in a clean state to the main cylinder. Secondly, he attaches to the frame of the carding engine under the main cylinder two supports or bends for carrying a number of boards or plates capable of being adjusted to any angle and position, and each having a portion of its surface in sufficiently close contact with the cards so that the cylinder may carry forward those fibres of cotton or other material which would otherwise be thrown off as fly or waste. *Patent completed.*

2376. C. Clark. *Improvements in tea and other trays for the table, used in urns and apparatus intended to be used therewith.* Dated August 27, 1862.

This invention consists in making trays for the table with a centre piece in or upon which the iron or apparatus for making and containing the tea, coffee, or other beverage is mounted or fitted, and with a moveable or rotating plate upon which the tea, coffee, and other services are placed, so as to be filled from the urn as they move or revolve therewith. The said plate or tray with its contents can then be moved at pleasure for serving purposes. *Patent abandoned.*

2377. G. Lindsay. *An improved mode of arranging and disposing guns in ships employed in naval warfare and otherwise.* Dated August 27, 1862.

This invention is carried out as follows:—Instead of placing the guns of ships above the water-line of the ship's draught, as commonly practised, the inventor proposes to place and employ them below the water-line, and to use them for attack or destructive purposes as a substitute for the ram now employed. The following are the means by which this invention may be carried into practical effect. He forms a circular hole through the ship's bows, and fits therein loosely a pipe, say six feet long or more, the said pipe having a flange formed thereon for connecting it to the mouth of a gun, either breech-loading or otherwise. The aforesaid pipe is surrounded by a stuffing-box placed inside the ship to enable the pipe to slide water-tight therein. A plug is used at the outer end of the aforesaid pipe to exclude entrance of water thereinto, and a slide valve placed at the inner end of pipe, being let down immediately on the discharge of the gun, excludes the water also from said gun. The gun is mounted on wheels for advancing same forward. In using a gun thus arranged, the pipe is caused to protrude through the ship's bows, so that, when the mouth of the pipe comes into contact with an opposed object, the pipe will be pushed back, and operating on mechanism, will discharge the contents of the gun, thus rendering such discharge of the gun self-acting. *Patent abandoned.*

2378. W. M. Mayes. *An improvement in, or addition to, wheels, particularly applicable to the wheels of railway and other carriages.* Dated August 27, 1862.

This invention consists in inserting in the nave of wheels, or in a box or casing surrounding the axle or nave, a spiral spring or springs. The springs surround the axle and all shock or jar to the axle during the running of the wheels is prevented. *Patent abandoned.*

2379. R. A. Brooman. *Improvements in machinery for separating or sorting and washing coal and other minerals.* (A communication.) Dated August 27, 1862.

The machinery hereafter described may be used for effecting the separation and washing of coal and other minerals, or for effecting one or other of those operations. The machinery for separating and sorting minerals is as first hereafter described. The material is introduced through a hopper, and is delivered on to a revolving horizontal disc, from whence it is forced by a stationary scraper on to a circular classing table, composed of a grating divided into several concentric belts or zones, in each of which the grating is of a different degree of fineness. When rotary motion is imparted to the horizontal disc at the rate of four or five revolutions a minute, the classing table is made to make one revolution per minute. A central shaft passing through the table supports one or several rakes, which stir up the material on the table. When the table has made about three-fourths of a revolution, a fixed stop bars the passage to such portion of the material as may not have passed through the grating in the outermost belt, and projects or guides it on to the next belt nearer the centre, and so on for all the belts. The matter passing through the several gratings falls in sorted masses on to separate annular tables under each belt, and is taken off for use or is received for washing in buckets on an endless belt, which raises it to the washing machine hereafter described. In the machinery last described, the gratings are in the same plane, but a modification of the machine is made by placing gratings of different degrees of fineness under one another. Scrapers remove or scrape from each grating such matters as may not have passed through them. In acting upon coal, the finest particles are subjected, after leaving the tables and before entering the buckets to be washed, to a strong blast, in order to drive off the lightest particles, which otherwise would form a kind of mud in the washing machine. The washing apparatus, which may be combined with or separated from the sorting machine, is constructed as follows:—A large piston made to move up and down is fitted in an open cylinder in a large tank. The piston is surrounded by a flat belt placed horizontally between two upright rings, and free to move upon rollers. The belt is formed of a grating covered with metallic cloth, upon which the materials to be washed are placed. The materials, when the two machines are combined, are delivered by an endless chain carrying buckets into the washing machine. The belt is so inclined that each of the points of its circumference, in the course of its rotation, plunges successively at the same spot in the tank, while each point diametrically opposite is entirely out of the water. The material to be washed is delivered on to the belt, and passed under a rule or guide to regulate the thickness of the layer on the belt. The belt then carries the material under rakes, which stir it up and mix it with the water. The belt takes on the materials under a scraper made to descend a given distance into them. This scraper removes the upper layer, and guides it into a bucket wheel, which delivers the materials out of the machine. Another set of scrapers acts in a similar manner on a deeper layer. When coal is being washed, these two layers comprise the best of the coal of two different degrees of purity. The third and remaining layers are removed by other scrapers and wheels, and any remaining refuse may be taken off by hand. *Patent completed.*

2380. W. E. Newton. *An improved method of producing light for the various purposes of artificial illumination.* (A communication). Dated August 27, 1862.

This patentee claims—1, The use of common or atmospheric air, in the place of oxygen gas, in the combustion of illuminating gas, or its equivalent, for the production of an intense degree of light, when such atmospheric air has been previously heated, and in that state is forced by properly arranged jets into intimate contact with the illuminating gas at or before the moment of combustion, both being at the same time made to impinge upon a suitable piece of lime, or other known equivalent substance, as described. , 2 The use of common atmospheric air in the combustion of illuminating substances, such as illuminating gas, oils, or hydrocarbons, or their equivalents, for the production of an increased degree of light, when such atmosperic air has been previously heated, and in that condition is brought in intimate contact with any of the said illuminating substances, at or before the moment of combustion as set forth. *Patent completed.*

2381. J. G. Nutting. *An improvement in the manufacture of buttons.* Dated August 27, 1862.

This invention relates more particularly to the metal button used for soldiers' clothing, but may also be applied to buttons suitable to ordinary clothing purposes. The invention consists in making the shank loose in the back of the button, instead of soldering it rigidly thereto as usual. By this means the shank may be pushed back into a recess made in the back of the button. The button is made hollow as usual, and the shank when pushed in will not project out from the body of the button, and will not, therefore, be liable to cut the clothing when the latter is tightly compressed, as is usual when required to be packed for transport on shipboard to distant countries. *Patent completed.*

2382. A. F. Newton. *Improved machinery for printing from engraved plates.* (A communication). Dated August 27, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2383. H. W. Cook. *Improved apparatus for obtaining motive power, applicable for driving machinery, or for other purposes where motive power is required.* Dated August 27, 1862.

This invention has for its object the employment of the axial force of electric coils to produce a motive power for driving machinery. *Patent abandoned.*

2384. J. J. Potter. *Improvements in upright pianofortes.* Dated August 27, 1862.

In the action of upright pianofortes it is common to employ a fixed rail placed in front of the fly to check it after it has escaped from the incline of the lever or instrument on which it acts. Now, according to this invention, the patentee employs this rail not only to check the fly, as heretofore, but also both to regulate the distance it enters under the incline of the lever, or instrument, and also to insure its escape up this incline at the proper instant. This he does by forming an incline on the under side of the check rail, and rising from back to front thereof, and he mounts an adjustable button on the fly; this bears on the incline of the check rail, and so regulates, according as the button is set, the distance the end of the fly enters under the incline of the lever or instrument on which it acts. And, further, when the finger-key is depressed, if the end of the fly does not of itself escape up the incline on the lever or instrument at the time it should, it will immediately be drawn off by the incline on the check rail, and thus blocking is effectually prevented. *Patent completed.*

2385. J. Kitchen. *Improvements in ventilators.* Dated Aug. 28, 1862.

This invention is carried into effect as follows:—A ventilator to be applied to (say) a roof of a building, may consist of a vertical cylindrical, or other suitably shaped pipe, the end being formed with an enlarged flanched lip extending downwards, and the lever end being formed with a trumpet mouth, and surrounded with a suitable perforated guard, suspending a hollow disc, having its concave side inwards. This shaft extends below the interior of the roof of the building a given distance, and is surrounded from the roof upwards by an octagonal or other suitably shaped casing, slightly tapering towards the top, and of sufficient capacity to form a chamber or passage between the outer surface of the first described vertical shaft and the inner side of the outer casing, forming a passage for the egress of the foul air which escapes between the upper edge of the outer casing and the curved enlarged flanche or lip of the inner shaft in a downward direction. The shaft and its outer casing is surrounded by a dome or other suitably shaped cap, which in the case of an octagonal outer casing is supported by eight brackets or trusses springing from the angles thereof, and is internally divided by vertical partitions into four equal compartments, and this cap being formed of a greater diameter, and having its lower edge extending downwards to a horizontal line with the lower edge of the turned lip of the vertical shaft (or thereabouts), forms the passage by which the fresh air enters and descends the vertical centre air shaft through the perforated guard into the room. The internal or fresh air shaft is fitted with a throttle valve which can be regulated by a cord carried over pulleys, or by rods and bars, or in any other convenient way. The inventor prefers to weigh the valve so that it will remain open through the cord or other gear. The foul air passage formed between the vertical shaft and the outer casing is also fitted with valves or ports, so that the whole or any portion of the passage may be closed at pleasure by means of a system of cords and pulleys, or in any other convenient way. The lower end of the outer casing immediately below the roof is surrounded by a funnel or trumpet-mouthed lip, and which on the under side is enclosed by wire work, or a suitable perforated plate. The lower edge of the dome or cap may also have lateral perforations formed therein for the admission of air. *Patent abandoned.*

2386. M. A. F. Mennons. *Improvements in smoke-consuming furnaces.* (A communication.) Dated August 28, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2387. M. A. F. Mennons. *An improved assorting apparatus applicable to the "numbering" of raw silks.* (A communication.) Dated August 28, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2388. G. Biddle. *An improvement or improvements in the manufacture of brooms.* Dated August 28, 1852.

In carrying out this invention, the inventor takes a broom head of the ordinary form, that is, of a semi-cylindrical form. He drills a series of longitudinal holes in this broom head in a plane parallel to the flat side, the number of the holes being equal to the number of rows of bristles, tufts, or knots of fibre to be placed in the broom. The said holes are drilled from one end to nearly the other end of the broom head. He also drills holes in the flat side of the broom head, for the reception of the tufts or knots of fibre, the last mentioned holes opening into the before-mentioned longitudinal holes. He takes fibres double the length of the tufts or knots in the finished broom, and he doubles the said fibres at their middle so as to make tufts or knots of the required size. By means of a large needle, a piece of strong string is passed along one of the longitudinal holes, and being drawn out of one of the holes in which the tufts or knots of fibres are inserted, the said string is passed over the doubled part of the tuft or knot, and the said tuft or knot is drawn into the said holes by the tightening of the string. The string is in succession passed over the doubled part of all the tufts or knots to be inserted in one row of holes, and the tufts or knots are drawn and fixed in the row of holes. The string is fixed by being wedged in the hole at the end of the broom head by means of a plug of wood. Tufts or knots of fibre are placed in a similar manner in the holes of each row. *Patent abandoned.*

2389. J. J. Moeckel. *Improvements in machinery or apparatus for spinning cotton, wool, or other fibrous materials.* Dated August 28, 1863.

This invention relates to the self-acting mule, and consists of an improved self-acting regulator, with a differential stretcher for regulating the action of the nut on the screw of the quadrant during the formation of the bottom of the cop. One of the band or chain pulleys connected to the carriage carries on a crank pin a pinion which revolves round and gears into two toothed wheels, one having one tooth more than the other. One of the said wheels is stationary, and the other revolves and gears into a larger toothed wheel working on a stud fixed to the carriage, and gives motion to a plate having in it an eccentric slot, which, as it turns, gives motion to a rod connected to one end of a lever on the counter faller shaft. To the other end of this lever is connected one end of a chain, the other end of which is attached to another lever on the same faller shaft. The chain at the bottom is connected to a brake lever for acting on a brake pulley fixed to a band or chain pulley attached to the carriage, and communicating motion to the screw of the quadrant. When the brake is relieved from the pulley, the latter resumes its rotation round the band, and the nut of the quadrant remains at rest; and the time at which this operation is performed is regulated or determined by the before-mentioned differential wheels and parts connected with them. The brake is suspended during the operation of spinning the other part of the cop by connecting one end of the chain to a lever on the faller shaft. *Patent completed.*

2390. E. Lachenal. *Improvements in gas metres.* (A communication.) Dated August 28, 1832.

We cannot here quote the details of this invention. *Patent completed.*

2391. W. Husband. *Improvements in water valves.* Dated August 28, 1862.

The patentee claims.—1, Casting or forging into one valve, or otherwise connecting two or more domes or rings, each with two or more beats, to close on a seat with four beats, more or less, always adapting the number of beats to the size of the valve or pump; the larger the valve the greater the number of beats that may be used with advantage. 2, Casting the arms which unite the various-inclined from a vertical plane, and in such a way that the valve when rising by the action of the water or falling through the water shall rotate, thus ensuring an equal wear or the beats, guides, and interior of valves. 3, Giving the upper part of the valve the greatest proportional lifting area, whenever there is sufficient height in the valve box, thus keeping the centre of gravity low down, and diminishing the tendency to cant to one side. And, lastly, Making the seating of the valve approximate to the form of a hollow cone, and dropping the valve therein, substantially as described and for the purposes set forth. *Patent completed.*

2392. G. Cooke. *An improved apparatus for securing and fastening doors to prevent robbery or intrusion.* Dated August 28, 1862.

This invention consists of a stick in the form of a walking stick, the upper part or handle being formed with a crescent or crutch-head for the purpose of placing it beneath the handle of a door, the key, or the lock itself. The crescent or crutch-head may be formed of a separate piece, and inserted into a hole bored in the upper end of the stick, and moved upward or downward, according to the height required to place it; and the crutch-head is to be kept up in its place by a metal pin passing through a hole in the upper end of the stick, and through any of the corresponding holes in the stem of the crutch-head. Thus, for travellers, this apparatus may be used as a walking stick, but when required for permanent or continued use as a fastening, the whole may then be made of iron. *Patent abandoned.*

2393. C. Humfrey. *Improvements in the treatment of petroleum to render it non-inflammable.* Dated August 28, 1862.

The object of the processes hereinafter described is perfectly to divest the petroleum of the gas it holds in solation. The inventor takes a closed iron vessel (an ordinary cylindrical steam-boiler with egg ends will answer the purpose), and fills it to about three-fourths of its capacity, or rather more, with petroleum. The steam-chest of this vessel is placed in communication with an air pump, and a vacuum or partial vacuum produced: under this influence the gas dissolved in the petroleum will be liberated freely, and being drawn off by the air pump will be blown away. The vacuum still being maintained, he heats the petroleum by means of a steam jacket, or dry steam worm, to about 120 deg. Fah., when a further quantity of gas will be disengaged and blown away by means of a perforated pipe placed at the extreme bottom of the boiler, and furnished with a stop cock. He then allows a current of atmospheric air to be drawn in minute streams through the petroleum; this, aided by the gentle heat and by the exhaust, will carry off the last portions of the dissolved gas. The petroleum may then be run into the casks from which it was taken, and be stored without danger. *Patent abandoned.*

2394. P. L. Guilband and N. V. Thire. *An improved self-inking hand stamp.* Dated August 29, 1862.

This improved hand stamp is engraved in the usual style on the projecting portion of the surface of a moveable cylinder; the ends of the axis of the said cylinder run in arms or levers hinged at the lower ends of a T-shaped frame, carried by a suitable handle; an inking-roller runs on the same levers, touching as it revolves the engraved portion of the cylindrical stamp. A pinion fitted on the said stamp is actuated by a segmental rack, which rack is carried by angular levers V hinged also on the ⊥-frame. The angular levers carry a segmental portion of a cylindrical frame, which, being applied upon the paper to be stamped and borne upon, caused, by pushing forward the rotary motion of the cylindrical stamp, the projecting engraved portion thereof to imprint its marks upon the paper, which the lower plain portion cannot touch, whilst the cylindrical segmental frame maintains the paper firm and even. Now when the stamp is lifted up, a spiral spring wound round the axis either of the stamp or of an intermediate pinion, by its unbending action, brings back the engraved cylinder to its primary position, in which motion the engraved portion is inked by the inking-roller. *Patent abandoned.*

2395. H. Jones. *Improvements in breech-loading firearms.* Dated August 29, 1862.

This invention relates to such breech-loading firearms as are opened at the breech for charging by the barrel or barrels turning upon a joint, the muzzle end of the barrels being depressed, and the breech end elevated and separated from the face of the body. In making breech-loading firearms of the kind described, the patentee effects the locking and unlocking of the barrels by means of a slight sliding motion. A bolt below the breech of the barrels is made by the said sliding motion to engage in a hole or recess in the face of the body, and a bar formed in the body at the same time engages in a horizontal slot in the lump on the under side of the barrels. The barrels are thus fixed in a horizontal position at two points during discharge. This bolting of the barrels is effected when they are made to slide horizontally towards the face of the body, and when they are made to slide in a contrary direction they are unbolted and can be turned upon their joint. The sliding motion of the barrels and the holding of the breech ends firmly to their bearing against the face of the body during the discharge of the gun, is effected by means of a lever on the under side of the body, the said lever having motion in a vertical plane. When the said lever lies horizontally on the under side of the gun, it holds the breech end of the barrels against the face of the body, and as the said lever is depressed into a vertical position, it liberates and gives them sufficient sliding motion to unbolt them and permit them to turn upon their joint. *Patent completed.*

2396. F. H. Lefranc. *Improvements in the manufacture of casks.* Dated August 29, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2397. W. Smith. *Improvements in the construction of furnaces.* (A communication.) Dated August 29, 1862.

This invention relates to furnaces for generating steam, and for other purposes, and is intended for burning fuel smokelessly and economically. The furnace bars are hollow, and arranged so as to form an inclined grate rising from the front upwards to the back; the bars are connected at their superior and inferior extremities to hollow transverse bearing bars, forming a tubular system through which the feed water is made to circulate rapidly, and is thereby heated before entering the boiler. The feed water enters the tubular arrangement at the lower transverse hollow bearing bar, and having circulated through the tubular grate, the supply of feed water thus heated is taken from the upper hollow bearing bar. By the disposition of the grate at a considerable angle upwards from the front to the back, the products of combustion arising from the distillation of the green fuel are, by the admission of the air in front and above the bars, made to pass downwards through the burning fuel and between the bars, and the gases and carbonaceous matters generated are consumed by the incandescent substratum of fuel, and the production of smoke thereby prevented, and thus the greatest amount of heat due to the combustion of the fuel is generated and utilized. *Patent abandoned.*

2298. J. Davis. *Improvements in the manufacture of spoons, forks, and similar articles.* (A communication.) Dated August 29, 1862.

This invention relates to the manufacture of spoons, forks, and similar articles when the same are stamped out of single pieces of sheet metal, and consists in giving the handles thereof a central corrugation, and a bead around such corrugation, for the purpose of imparting strength to the narrow and weak part of the handles, whilst at the same time the hand obtains a better grasp, and the appearance of the article is improved. In the manufacture of spoons, the aforesaid corrugation and bead are to be carried into the bowls thereof. The corrugation and bead are formed by suitable dies when the articles are being constructed by the processes well known in the manufacture of such articles. *Patent completed.*

2399. H. Harben. *Improvements in the manufacture of cotton, cotton fibre, and other similar fibrous productions.* Dated August 29, 1862.

In carrying out this invention, the inventor uses sea-weed or other aquatic vegetable production, either whole or in pieces, and steeps it in fresh water for the requisite period, for the purpose of extracting any salt and otherwise cleansing it. He then separates the fibre from the waste, either by hand labour or by the most approved method now in use for similar purposes, or by machinery and hand labour combined; or, instead of fresh water, as above, he cleanses and looses the fibres by steeping the plant or weed in a solution of American potash, or other suitable liquid composition or gas. The work for loosening the fibres may also be performed by crushing or scarifying the peant or weed by machinery, or by subjecting it to steam. *Patent abandoned.*

2400. George Dyson. *Improvements in machinery for finishing and polishing circular metal rods, bars, and shafts: applicable also to the manufacture of metal tubes and pipes.* Dated August 29, 1862.

This machinery consists of a pair of rolls, set slightly at an incline, and each inclined in an opposite direction to the other, both rolls being driven in the same direction. The rod, bar, or shaft is introduced between guides and between the ends of the rolls, and at right angles or nearly so to the direction in which the rolls are driven; then upon the rolls being made to rotate through toothed gear, the rod, bar, or shaft is drawn between the rolls in a direction at right angles or nearly so to the circumference thereof, and is thereby rendered cylindrical, smooth, and polished. *Patent completed.*

2401. W. Owen. *Improvements in the manufacture of railway wheels and tyres, and in securing tyres to wheels.* Dated August 29, 1862.

This invention is not fully described apart from the drawings. *Patent completed.*

2402. P. W. Mackenzie and S. W. Smith. *Improvements in vehicles to be propelled by the rider.* Dated August 29, 1862.

The first part of this invention relates to the construction and combination of parts by means of which the propulsion of the vehicle is accomplished. In this device a double-cranked axle is used, and in the arrangement which the patentees have adopted as the best, two cranks are formed in the same parallel line to the centre, and one upon the side opposite, and at the same time or nearly the same distance from the centre of rotation. The seat of the rider is connected to the two cranks which are on one and the same line, and the pedal upon which the feet press are connected to the other crank for the purpose of giving continous rotation, and, consequently, locomotion by means of the transfer of the weight of the body alternately from the seat to the pedal and *vice versa*. The second part of this invention relates to the mechanism hanging and supporting the steering wheel, it being supported in segmental bearings. The segmental bearings in which it is hung, are allowed to turn in a circular plate made in two parts, and attached to the parts which extend down astride of the said steering wheel. The third part of the invention relates to the manner of connecting and arranging the steering gear in relation to other parts. A forked lever is attached either to the segmental bearings or to the axle of the steering wheel, which, by means of a further lever and other connections, is operated by a cross bar or bit with reins attached the same as an ordinary bridle. The seat of the rider the patentees usually prefer to make in the form of a horse, and the bit is then placed in the mouth of the figure of the animal. The fourth part of this invention relates to the construction of the seat of the rider in such a manner as to give an erect position to the rider, and so mounting the said seat on wheels as to facilitate the operation of propelling the vehicle by giving the body and lower limbs a position and opportunity to change their position in a manner suitable to effect that purpose, the construction and arrangement of parts being such that the vehicle can be guided in any direction. The fifth part of the invention relates to making the body of the figure of the horse or other seat hollow, and the disposition of the steering gear in relation thereto, so as to make the seat as light as possible, and cover and protect the gear. *Patent completed.*

2403. R. Courtenay. *Improvements in obtaining motive power.* Dated August 29, 1862.

This invention consists in producing motion by changing (increasing or diminishing) the specific gravity of an elastic fluid, the change being effected by revolving weights. *Patent abandoned.*

2404. W. Upfill, W. Morton, and W. Asbury. *Improvements in the construction of wheels and axletrees for carriages.* Dated August 29, 1862.

This invention relates to a novel mode of constructing and combining the naves and axle-boxes of wheels, and also to a novel mode of securing the nave or axle-box of the wheel to the axletree. In carrying out this invention the nave and axle-box are constructed separately; but previously to being adapted to the axletree they are secured together by screwing or otherwise. The nave which receives the spokes of the wheel is bored out or cast with a hole to fit on to the axle-box, on which it is secured by a screwed cap, or by bolts, or otherwise. By this means the nave, with its cap and axle-box are all connected together and form one piece, which is secured on to the axletree by means of tongues, pins, studs, or projecting pieces, which are made to take into a groove or grooves cut or made round the axletree. These tongues, pins, studs, or projecting pieces are made moveable, and are inserted in dovetailed grooves or sockets made in the metal washer, which is by preference cast on to the end of the axle-box, but may, if desired, be made separate; and in order to prevent these tongues, or their equivalents, from coming out accidentally, they are secured in their places by cross pins or screws. *Patent completed.*

2405. E. A. Pontifex. *Improvements in the manufacture of steam traps.* Dated August 29, 1862.

This invention is carried into effect as follows:—The steam and water are allowed to enter a reciprocating rocking or moveable vessel or chamber, which is properly balanced, and is provided with valves or openings which are opened and closed as the vessel rises and falls. When the balanced vessel has received a given weight of water from the condensation of the steam, it will be carried down by its weight, and in so doing will uncover or open a valve at the bottom of the vessel, and allow the water to run out. The vessel thereby lightened will then be raised up again by the counterbalance weights to its original position, and will close the exit openings or valves until more water or condensed steam accumulates in the vessel, when the latter will descend again, and will allow the water to run out *Patent completed.*

2406. E. T. Hughes. *Improvements in the manufacture of woven fabrics.* (A communication.) Dated August 30, 1862.

This invention consists in using straw instead of the usual materials for the weft with any strong material, such as flax or hemp, for the warp-threads; cotton or wool may be used, but it will not be so durable as flax. The inventor uses an ordinary loom, such as is generally used for weaving linen cloth; but to facilitate the use of the straw, he makes the shuttle with a spring from the centre extending to each end, the ends of which spring being pressed down allows the straw to enter the openings. To keep up the supply of the straw weft, he places an assistant at each side of the loom (a child will be sufficient), and supplies each of them with one or more extra shuttles, so that they will always be ready with a charged shuttle to place on the loom as it is required. This fabric may be advantageously used for carpets, floor-cloths, window-blinds, and similar purposes. *Patent completed.*

2407. E. C. Harding and C. Doody. *Improvements in braces.* Dated August 30, 1882.

Instead of the ordinary method of buttoning the braces to the back and front of the trousers, the patentees fasten them to the sides, and dispense with the back buttons altogether. They form each of the main bands of the brace of two parts placed in an angular position with each other, and attach the two main bands so formed by a cross-piece at the back, at or about the shoulders, and bring one end of each band to the side and attach it to the trousers or to straps buttoned to them; the other end of each band is brought over the corresponding shoulder and attached to the band near the trousers, or directly to the side of the trousers, either of which arrangements will prevent the trousers dragging or tearing when the the wearer is in the act of stooping, or in a sitting posture, as well as securing many other advantages. *Patent completed.*

2408. F. Le Conte. *Improvements in the construction of furnaces for steam boilers used in sugar mills, distilleries, breweries, &c.* Dated August 30, 1862.

This invention consists, essentially, in the production of whirlwinds of air by means of the bars of the focus of a fireplace, the air escaping through openings made in the bars in contrary directions. This effect is obtained by giving passage to straight or direct currents of air, and to other currents of air directed perpendicularly or obliquely upon those first-mentioned, and the form of the bars may vary, so that this main condition be preserved. *Patent completed.*

2409. W. E. Gedge. *Improvements in machinery or apparatus for manufacturing velvet.* (A communication.) Dated August 30, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2410. J. H. Johnson. *Improvements in coating or covering metallic surfaces with copper.* (A communication). Dated August 30, 1862.

This invention relates to the coating or covering of wrought or cast iron, zinc, or other metallic surfaces with copper, by means of the magneto-electric or electro-galvanic processes, and consists in the employment of certain peculiar compositions, which are applied by means of a brush or other suitable method to the metallic surfaces to be coated with copper, before placing them in the cupreous bath for the purpose of forming an intermediate coating between the copper to be deposited and the metallic surface to be covered or coated, thereby avoiding the deleterious action which arises frequently when the copper is in immediate contact with the metal upon which it is deposited. *Patent completed.*

2411. J. Meyer. *Improvements in mechanism for the production of Jacquard cards, and in the said cards or card-boards.* Dated August 30, 1832.

This invention is not described apart from the drawings. *Patent completed.*

2412. G. N. Alleyne and J. Roberts. *Improvements in the manufacture of flanged wrought-iron or steel plates, or of wrought-iron beams and frames of a trough-shaped section.* Dated September 1, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2413. J. Nickson and T. Waddingham, jun. *Foundation or groundwork for plaster for ceilings, walls, partitions, &c.* Dated September 1, 1862.

This invention consists in the use of plates or slabs of slate, metal, earthernware, or other similar and suitable material perforated with round, square, or other shaped holes, or with oblong slots for the purpose of retaining the plaster, a space being left between the adjoining edges of the plates when placed in position for the same purpose. The said plates are nailed or otherwise attached to the joists, spars, or battens, and are made of a suitable size to cover the spaces between the same; or they are attached to studs projecting at suitable intervals from the surface of the wall to be covered, so as to leave a space between the wall and the plastering, which is more particularly adapted to the outer walls of buildings, or to walls exposed to damp. *Patent completed.*

2414. J. Walker. *Improvements in the treatment of kelp.* Dated September 1, 1862.

The patentee claims the preparing of hydrosulphite of soda, borax, iodide of sodium, iodide of potassium, and iodine from or by means of kelp liquors or products, as described. *Patent completed.*

2415. W. E. Gedge. *Apparatus for washing the felts of paper-making machines.* (A communication.) Dated September 1, 1862.

This apparatus is composed of a wooden or cast-iron receiver or reservoir, fed by a current constantly renewing and keeping the water in the reservoir at the same level. This apparatus is placed beneath the felt coucher, which is brought to it by rollers when retained empty or uncharged. In the apparatus and beneath the water are two parallel rollers, working the one towards the other, and exercising on the felt, which passes between them, a pressure which purges it from the foreign and earthy matters with which it may be charged. On leaving this bath, the felt passes through two other rollers covered with felt or caoutchouc, the pressure of which frees it of the excess of water, and clears off any remaining extraneous matters, so that thus disembarrassed it presents itself anew beneath the press and the wet paper carrier in a thoroughly clean state, and as the felt is thus washed at each revolution, it may be worn out on the machine without ever having been removed for washing. *Patent abandoned.*

2416. J. Ellis. *Improvements in corsets.* Dated September 1, 1862.

This invention consists in combining a great number of narrow pieces of linen or other coutille, or other suitable material, each piece being cut or shaped according to the figure and the size of the article required. Although the patentee prefers to make corsets according to this invention from fifty separate pieces of material, any greater or lesser number may be employed. He joins several narrow pieces of material together side by side, by overlapping to such an extent as when two single or double rows of sewing or stitching have been made, a space will be left along the sewn joints forming a groove or channel, into which a piece of whalebone or other suitable material is inserted, and such pieces of material may be plain or covered. *Patent completed.*

2417. J. W. Newton. *Improvements in apparatus for preparing, spinning, and doubling cotton, wool, &c.* Dated September 1, 1862.

This invention consists—First, in an improved method of effecting the twisting or winding on of the yarn or preparings, either in the form of cops or bobbins, by means of a ring, instead of the ordinary flyer, which ring is used in the several operations of preparing, spinning, doubling and twining, and is applicable to all machines where flyers are used in the manufacture of yarns or threads of cotton, or other fibrous substances. Secondly, in improved methods of obtaining the drag when spinning and doubling. The details are voluminous. *Patent aompleted.*

2418. E. G. Fitton. *Improvements in machinery for winding yarn and thread on to bobbins or spools.* Dated September 1, 1862.

This invention consists—First, in a novel combination and arrangement of mechanism, whereby the mechanical movement or action, which in the ordinary machine drives the single spindle and regulates the winding on and pressing down of the thread on a single spool or bobbin, is applied simultaneously to two or more spindles, and the spools or bobbins thereon in the same machine, by which means the operative is enabled to attend simultaneously to as many spools or bobbins as there are spindles in the machine, instead of to one only. Secondly, in the application and adaptation of toothed gearing to hand spooling machines for connecting two or more spindles when several are employed in the same machine, in order to secure greater regularity in winding than when such spindles are driven by bands or cords. Thirdly, in the application of a spring made of india rubber, or any suitable compound thereof, to each guide or presser used for guiding and pressing down the yarn or thread, whereby the necessity of pressing the guide by hand is obviated. Fourthly, in a novel arrangement of mechanism, whereby the several guides or pressers used for guiding and pressing the yarns or threads on the several bobbins in the same machine can be simultaneously operated upon, and which the patentee effects by the following means:—A cord or chain attached to a lever passes partially round antifriction bowls or pulleys placed upon the fixings on which the guides or pressers are supported, so that by pressing down the lever, either by springs, weights, or the hand of the attendant, a suitable degree of pressure is given to as many pressers as may be arranged in one machine. Fifthly, in an arrangement of mechanism, wherein a series of pins on one or more vertical bar or bars raised and lowered by levers or other convenient means act simultaneously on the guides or pressers, so as to lift and hold them up or allow them to be depressed as required. Sixthly, in the application and arrangement of mechanism wherein a lever brought into action by the hand or foot of the attendant moves one or more sliding bars or levers to which a doffer plate is attached, so as to push or liberate the bobbins from the spindles. Seventhly, in an arrangement of parts applied to such machine as aforesaid to polish or size at the same time the yarn or thread on as many bobbins or spools as there are spindles in the machine, by the means of a socket or slide attached to the traversing bar, or to each of the presser fixings, or to other convenient part or parts of the machine, in or on which socket or slide a piece of wood or other substance is placed covered with a suitable material for polishing. *Patent completed.*

2419. J. Watt and T. S. Haviside. *Improvements in the treating of flax and other similar vegetable fibrous substances to be used as substisutes for cotton.* Dated September 1, 1862.

This invention consists in subjecting the flax or other similar fibrous substance to the action of proto-carbonate of soda, or bi-carbonate of soda, or proto-carbonate of potassa, or bi-carbonate of pottassa, or soda ash, in solution in water, and heating the whole to the boiling point, and boiling the same until the fibrous substance has been so acted upon that, upon being washed and treated with an aqueous solution of chloride of lime or chloride of soda, it is converted into a substance which may be applied as a substitute for cotton. *Patent completed.*

2420. W. Edge. *Improvements in Albert chains.* Dated September 1, 1862.

This invention consists in constructing Albert chains as follows:—The inventor makes a ring at or near the middle of the chain, which is so arranged that the ends of the chains can easily be released, being constructed with a small hinged portion which is kept in its place by a spring to make a break in the ring, so as to insert the ends of the chain; this hinged portion is pressed inwards with the finger. The ring also supports the chain, locket, and other ornaments. To fix it to the vest, the chain is passed through the button hole, and the end put on the break ring. An ordinary hook or fastening may also be used, but it is not necessary for the safety of the chain. *Patent abandoned.*

This invention consists in means for producing the combustion of light hydrocarbons, light coal or petroleum oils, and generally of all easily vaporizable liquids, in order to obtain light and heat, and also for the production of mechanical power from the gas thus obtained. *Patent completed.*

2422. J. H. Johnson. *Improvements in the manufacture of braid.* (A communication.) Dated September 1, 1862.

This invention relates—1, to an improved manufacture of flat braid, and consists in making such braid with the borders or selvages thinner than the body or centre portion thereof. According to one mode of producing a braid having this peculiarity, it is proposed to construct a machine somewhat similar to an ordinary flat braid machine, but provided with separate bobbins working in grooves of their own for forming the borders or selvages, and so actuated as to lock their threads with the threads of the other bobbins forming the body of the braid. In order that the borders may be considerably thinner than the body, it is proposed to have fewer thicknesses of thread on the bobbins forming the borders—for example, if each of the bobbins forming the body of the braid have three threads, the outer bobbins will only be supplied with one thread, thus forming the border one-third the thickness only of the body of the braid, which has never heretofore been accomplished. It is, of course, requisite that the speed of the bobbins making the borders should be greater than that of the bobbins making the body of the braid in proportion to the difference in the number of threads carried by each set of bobbins, so that the borders, although made of one thread, for example, will be produced as fast as and keep pace with the body of the braid made from two or more thicknesses of thread. The above-mentioned arrangement affords facility for making braid of two or more different colours—that is to say, on longitudinal stripes. The second part of this invention relates to certain peculiar constructions and combinations of parts of braiding machines, whereby their productive powers are greatly increased, whilst the work executed is superior to that produced in ordinary braiding machines. *Patent abandoned.*

2423. J. H. Johnson. *Improvements in apparatus for regulating or controlling the working of motive-power engines.* (A communication.) Dated September 1, 1862.

This invention relates to an improved mode of regulating or controlling the working of steam, air, or gas engines, or hydraulic prime movers, and consists in causing the steam or other medium employed for working the engine, to act upon the regulating apparatus in its passage from the generator or source of supply to the cylinder or other acting agent as the case may be. *Patent completed.*

2424. D. B. Peebles. *Improvements in wet gas meters.* Dated September 2, 1862.

This invention comprises improvements in various parts of wet gas meters, and which may be used together or separately. A first improvement relates to the valve in the inlet chamber used to shut off the gas when the water in the meter is too low. By the present invention, the float which keeps this valve open is placed in a compartment open at its upper part to the drum case, and separated from the front case by a partition dipping down below the water. A bent wire passing under the partition connects the float and valve. The result of this arrangement is, that a sudden increase of pressure in the service pipe will not close the valve (as frequently happens in ordinary meters), its tendency to do so being counteracted by the opposite tendency of the float, since the pressure in the front case will depress the water therein, and thereby elevate it in the float compartment, and the float with it. A second improvement is designed to prevent a sudden increase of pressure from throwing water up into the compartment containing the counting mechanism. Besides the tube usually surrounnding the vertical counter-spindle, and dipping down below the water surface to seal the communication, there is a second tube which may either encircle the first or be beside it. These tubes communicate with a small chamber near the top of the case, and within this chamber the spindle has fast on it a disc, and any water thrown up one tube strikes this disc, and being deflected thereby runs back by the other tube. A third improvement relates to contrivances in connection with a closed fountain chamber for compensating for the lowering of the water-level in the meter from evaporation or otherwise. *Patent abandoned.*

2425. J. Mosheimer. *Improvements in machinery for amalgamating gold and silver, or the ores thereof.* Dated September 2, 1862.

This invention relates to the machinery employed in the separation of gold and silver from their ores by the agency of mercury, and consists, first, in the use of metal mullers revolving in a circular pan or annular trough, the bottom of which is flat or nearly so, and upon which the materials to be triturated and amalgamated are spread. A second part of the invention consists in admitting steam to a space underneath the bottom of the pan for the purpose of facilitating the amalgamation of the metals. *Patent completed.*

2426. W. Hunt. *Improvement in the manufacture of muriate of ammonia.* Dated September 2, 1862.

The patentee claims manufacturing muriate of ammonia by passing a mixture of volatilized muriatic acid and atmospheric air, or uncombined nitrogen, through burning coke or coal, or other carbonaceous fuel; or passing a mixture of atmospheric air, or uncombined nitrogen, through ignited fuel, with which fuel has been mixed chloride of manganese, chloride of iron, or other chloride capable of yielding chlorine or muriatic acid when heated. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Feb. 11, 1863.

378. H. Wycherley, carriage builder, Oldbury, Worcester. Certain improvements in the construction of and mode of applying wings or dirt screens over the wheels of carriages.

Dated Feb. 13, 1863.

386. S. M. Innes, Hill House Hill, Millbrook, Hampshire. Improvements in the construction of pianofortes.

Dated Feb. 14, 1863.

397. G. Haseltine, 12, Southampton-buildings, Chancery-lane. Improvements in lever horse-power machines, the cog-gearing employed being applicable to other machines. (A communication.)

399. J. C. Jeffcott, Anglesey-street, Cork. Improvements in the production and generation of gases, and also in apparatus connected therewith.

Dated Feb. 19, 1863.

453. W. Sherwood, Birmingham, silversmith. An improvement or improvements in wine glasses.

455. R. Pinkney, 18, Bread-street-hill, London, wholesale stationer. Improvements in the manufacture of metallic pens.

457. W. Trustrum, 2, Marlborough-road, Old Kent-road. Improvements in the manufacture of oiled silk.

Dated Feb. 20, 1863.

459. H. B. Barlow, Manchester, patent agent. Certain improvements in weaving, and in the machinery employed therein. (A communication.)

461. W. Marsden, 49, Old Bailey. Improvements in buttons and other similar fastenings, and in the modes of attaching or securing the same.

463. J. Bentley, manufacturer, and H. Booth, overlooker, Pilkington, Lancashire. Improvements in looms for weaving.

465. W. Hainsworth, Rothwell, near Wakefield, York, founder. Improvements in the manufacture of cast-iron pipes, columns, or any description of tubing.

467. W. Clark, 53, Chancery-lane, patent agent. An improvement in boilers for disintegrating and pulping vegetable substances. (A communication.)

469. F. W. Benndorf, Chemnitz, Saxony. Improvements in governors or apparatus for regulating the speed of steam engines, or other engines for driving machinery.

Dated Feb. 21, 1863.

471. C. Malpas, Soho Mills, Tunstall, Stafford. Improvements in ovens or kilns for firing, burning, or baking pottery, bricks, tiles, and other earthen or ceramic articles.

473. H. Kilshaw, Haslingden, Lancaster, cotton spinner and manufacturer, and T. Elce, jun., Manchester, machine maker. Certain improvements in machinery for preparing and doubling cotton and other fibrous substances.

475. E. T. Hughes, patent agent, 123, Chancery-lane. Improvements in the treatment of colouring matters derived from tar for the purpose of making them applicable for painting. (A communication.)

477. A. H. Rémond, 4, Moorgate-street, London. Improvements in preserving provisions, and in the apparatus employed for such purpose.

479. W. Wood, Monkhill, near Pontefract, York. Improvements in the process of manufacturing pomfret or liquorice cakes, rolls, sticks, and pipes, and other similar articles of confectionery.

481. J. Brown, Atlas Steel and Iron Works, Sheffield. York. Improvements in the manufacture of armour plates for ships and other structures. (A communication.)

483. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the construction of wind instruments of music. (A communication.)

Dated Feb. 23, 1863.

485. W. H. Gauntlett, South Bank Iron Works, Middlesbro'-on-Tees, York. Improvements in apparatus for heating the blast in the manufacture of iron.

487. J. Eckersley, Westhoughton, Lancaster, mechanic. Improvements in spinning and doubling silk.

489. J. P. F. Datichy, Margaret-street, engineer. Improvements in steam engines.

491. R. Martindale, Birmingham, manufacturer. Improvements in lamps and burners, and in apparatus employed for milling or ornamenting parts of lamps, which apparatus may also be applied to other similar uses.

493. T. and A. L. Dickens, and H. Heywood, Middleton, Lancaster, dyers and printers. Improvements in ornamenting plush and other such textile fabrics.

495. J. Erwood, 91, Goswell-street, paper stainer. Improvements in producing imitation gilding on paper hangings and other surfaces, also in metal leaf and metallic or bronze powder suitable for the purpose.

Dated Feb. 24, 1863.

497. D. Spink, Esq., Spaxton, near Bridgewater, Somerset. Improvements in the construction and arrangement of armour plates for ships.

498. W. and H. Whitehead and H. Barber, spring knife

cutlers, Ecclesall Bierlow, Sheffield, York. Improvements in the manufacture and securing of cutlery handles, and machinery employed therein.

501. G. Davies, 1, Serle-street, Lincoln's-inn, patent agent. An improvement in melting and smelting furnaces. (A communication.)

505. W. Hooper, London India-rubber Works, Mitcham, Surrey. Improvements in insulating and protecting telegraphic and other wires and rods, and in machinery connected therewith.

507. E. R. Walker, Haigh, near Wigan, Lancaster, engineer. Improvements in valves, and in apparatus connected therewith.

509. G. A. Huddart, Brynkir, Carnarvon, gentleman. Improved means of imparting heat to fluids.

511. T. Mallinson, machine maker, Globe Works, Manchester, and J. Livingston, mechanic. Improvements in throstle spinning and doubling frames, wholly or partly applicable to roving and slubbing frames.

513. G. Bower, St. Neots, Huntingdon, gas engineer, and W. Hollinshead, engineer. Improvements in apparatus for the production and transmission of gas or other fluids.

515. W. H. Lapthorn, Broad-street, Portsmouth, ship chandler. Improvements in reefing and furling ships' square sails.

Dated Feb. 25, 1863.

517. F. A. Gatty, Accrington, Lancaster, manufacturing chemist. Improvements in printing and dyeing cotton and other fabrics.

518. R. Maynard, Whittlesford, Cambridge. Improvements in portable chaff-cutting machines.

519. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in lamps for burning petroleum and other similar oils, and in feeders or cans for supplying such oils to lamps. (A communication.)

521. W. Readman, Glasgow, manufacturing chemist. Improvements in the manufacture of carbonate of magnesia, and of iodine and kelp salt, and other products from kelp.

523. J. B. Green, Hayle Mill, Maidstone, Kent, paper manufacturer. Improvements in the manufacture of paper.

525. J. Gailey, Princes-street, Chelsea, joiner. Improvements in apparatus for the purpose of supplying air for mixture with gases and other aeriform fluids.

527. H. H. Henson, 13, Parliament-street, Westminster, engineer. Improvements in mats.

529. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in producing stereotype plates for printing purposes. (A communication.)

531. N. Thompson, Abbey-gardens, St. John's-wood. Improvements in machinery for sawing wood.

533. A. Macivor, Edinburgh University, chemist. Improvements in veneering or overlaying woods according to two methods—1st, by means of steam exhaustion or steam pressure, or air exhaustion or air pressure; 2nd, by the employment of electro-magnetism.

Dated Feb. 26, 1863.

537. C. Ritchie, engineer, South-street, Finsbury-market. An improved machine for making spiral lighters or spills from wood or other substance, and which machine will make and colour them when desired at one process or operation.

539. W. A. Wilson, engineer, and J. Smith, baker, Liverpool. Improvements in furnace fire-grates.

541. A. P. Price, 47, Lincoln's-inn-fields, gentleman. Improvements in the production and manufacture of blue colours. (A communication.)

543. P. Spence, Newton Heath, Manchester, manufacturing chemist. Improvements in the manufacture of potash, alum, and other salts of potash.

545. M. Puddefoot, Blisset-street, Greenwich, hat manufacturer. Improvements in implements for tilling and cultivating land.

547. R. J. Nodder, Liverpool, hat manufacturer. Improvements applicable to hats, caps, helmets, military head dresses, and other like coverings for the head.

Dated Feb. 27, 1863.

549. J. H. Albinson and H. H. Cocker, Bolton, Lancaster, silk spinners, doublers, and throwsters. Improvements in spinning, doubling, throwing, and reeling silk, and in the machinery employed therein.

552. E. T. Hughes, patent agent, 123, Chancery lane. Improvements in machinery or apparatus for doubling or twisting yarn, thread, braid, rope, or similar articles. (A communication.)

553. J. Carver, Butcher-street Works, Nottingham, bobbin and carriage manufacturer. Improvements in the arrangement or fixing of combs in machines employed in the manufacture of bobbin net or twist lace.

555. J. Fry, Chesham, Buckingham, engineer. Improvements in mashing machinery used in making fermented liquors.

558. W. Gray, Sheffield, machine knife manufacturer. Improvements in the manufacture of beaters for thrashing machines.

559. W. Clark, 53, Chancery-lane, patent agent. Improvements in pumping and forcing water, and in apparatus for the same. (A communication.)

561. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in machinery or apparatus employed in the preparation or treatment of hemp or other textile materials. (A communication.)

Dated Feb. 28, 1863.

562. B. West, 2, St. James'-walk, Clerkenwell, bookbinder. An improvement or improvements in metallic pens.

563. G. Royle, 32, King's-street, Cheapside. A new or improved apparatus for creasing or marking rouches.

564. W. Hadfield, Bolton, Lancaster, boiler maker. Improvements in steam boilers and in the arrangement of flues in connection therewith.

565. J. W. Friend, Freemantle, Southampton. An improved gas meter.

567. J. Maxfield, Warrington, Lancaster, brewer. Certain improvements in brewing and in apparatus employed therein.

568. S. Williamson, Sheffield, engineer. Improvements in the construction of furnaces.

569. D. Collinge, Oldham, Lancaster, cotton spinner and manufacturer. Improvements in machinery or apparatus for cleaning, steaming, and preparing cotton or other fibrous materials to be spun.

570. E. Paine, Liverpool, master mariner. Improved apparatus for facilitating the cleaning of vessels' bottoms while afloat.

571. T. E. Symonds, Adam-street, Adelphi, Commander in Her Majesty's Navy. Improvements in the construction of screw-propelled ships, and in the arrangement and mode of disconnecting, withdrawing, and lifting screw propellers.

572. J. Penn, Greenwich. Improvements in escape or relief valves to the cylinders of marine and other steam engines.

573. J. Courtonay, 9, Down-street, Piccadilly. Improvements in obtaining motive power. (A communication.)

574. E. Hayes, Stony Stratford, Bucks. Improvements in supplying water to surface condensers of marine engines.

575. S. Bateman, Low Moor, near Bradford, York. Improvements in the manufacture of wire rope and cordage, and in the machinery employed therein.

576. G. Haseltine, 12, Southampton-buildings, Chancery-lane. Improvements in sewing machines. (A communication.)

Dated March 2, 1863.

577. O. Murrell, Bethnal-green-road. Improved arrangements for generating steam in steam boilers and other vessels, and for heating the liquid contents thereof.

578. F. Tolhausen, 17, Faubourg Montmartre, Paris, patent agent. Improvements in cloth blankets and other fabrics to be used in machinery for printing fabrics, paper hangings, and letter press. (A communication.)

579. J. W. Burton, Leeds, gentleman. An improved mode of refining and purifying oils.

581. G. Hawksley, Sheffield, manufacturer, and T. Bissell, 75, Tooley-street, London, gun maker. Improvements in powder chargers.

582. E. Habel, Manchester, machinist, and E. Suckow, machinist. Certain improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous substances.

583. T. Taylor, 7, Wellington-row, Bethnal-green. Manufacture of a new or improved fabric, and its application to the formation of ornaments for fire-stoves and other decorative purposes.

584. C. Garton, Bristol, brewer. An improved method of applying heat in the manufacture and refining of sugar, and in malting, hop drying, brewing, distilling, and vinegar making.

585. J. S. Wells, Mount-street, Nottingham. Improvements in the manufacture of stockings and other looped fabrics made in knitting machines.

Dated March 3, 1863.

587. T. E. Symonds, Adam-street, Adelphi, Commander in Her Majesty's Navy. Improvements in the apparatus for steering ships.

588. T. Emmott, Vale Mills, Oldham, Lancaster, cotton spinner and manufacturer. Certain improvements in mules for spinning and doubling.

589. R. Saunders, Croydon, Surrey. Improvements in metal sheathing for ships and vessels, and in the securing of such sheathing thereto.

590. G. F. Lyster, Liverpool, engineer. Improvements in mooring buoys.

591. R. H. Jones and J. Abrahall, Birmingham, jewellers. Improvements in bracelets and brooches.

592. G. Davies, 1, Serle-street, Lincoln's-inn, patent agent. Improvements in polishing or giving a lustre to soap, and in the apparatus employed in such process. (A communication.)

593. J. Henderson, Bradford, York, carpet manufacturer. Improvements in machinery or apparatus for the manufacture of carpets and other piled fabrics.

595. J. Sibert, Nottingham, machinist. Improvements in apparatus for winding and measuring lace.

596. G. Lamb, 9, America-square, Minories. Improvements in apparatus for recording the revolutions of the propelling shaft of a steam ship or vessel.

597. T. Erich, 77, Newgate-street. Improvements in machinery for pressing peat. (A communication.)

598. D. B. Parsons, 77, Upper Thames-street. Improvements in reaping and mowing machines. (Partly a communication.)

599. B. S. Cohen, 9, Magdalen-row, Great Prescott-street, Goodman's-fields, pencil manufacturer. Improvements in apparatus for protecting the points of pencils.

600. W. Parsons, Earl-street, Edgeware-road, engineer. Improvements in dining tables.

Dated March 4, 1863.

602. C. M. Palmer and J. McIntyre, Jarrow, Durham, ship builders. An improved mode of applying and fastening metal sheathing to the bottoms of iron ships or vessels, and to iron for other uses.

606. T. H. Morrell, Leyland, Lancaster, gentleman, and J. Williamson, Willcross, Gisburn, York, gentleman. A new or improved method of purifying the noxious vapours or gases given off from night soil or other similar substances during the heating, drying, or evaporating of such substances.

607. E. A. Wünsch, Glasgow, merchant. Improvements in treating seaweed, and in apparatus therefor.

610. E. W. Binney, 40, Cross-street, Manchester, gentleman. An improved lamp burner. (A communication.)

611. W. Clark, 53, Chancery-lane, patent agent. Improvements in the manufacture of sulphuric acid, and in apparatus for the same. (A communication.)

612. W. Hamilton, 13, Paternoster-row, advertizing agent. Improvements in means or apparatus for registering suitable for advertizers' purposes.

613. J. Craig, Weston-park, Shipston-on-Stour, Worcester. Improvements in apparatus for detecting and detaining thieves, and indicating the presence of fire.

614. W. L. Tizard, Birmingham, engineer. Improvements in manufacturing curvated armour plates and other iron work, and in machinery or apparatus employed therein.

Dated March 5, 1863.

615. W. Whittle, Smethwick, Stafford, mechanical engineer. Improvements in machinery for the manufactzre of nails.

616. T. Thornton, E. Thornton, and R. Thornton, Elland, York, manufacturers. Improvements in machinery or apparatus for preparing wool or other fibrous substances for spinning.

617. J. Clinton, 35, Percy-street, Tottenham-court-road, professor of music. Improvements in the construction of flutes.

618. W. Allen, cotton spinner, and W. Johnson, Newton Moor, manager. Certain improvements in machinery or apparatus for grinding "cards" employed in carding engines.

619. R. D. Dwyer, Manchester, engineer. Certain improvements in springs to be employed in the manufacture of beds, seats, or for similar purposes where an elastic surface is required.

621. W. Wells, Ryder's-court, Leicester-square. Improvements in horse-shoes and in the method of fastening the same.

623. S. H. Foster and T. Bunney, Leicester, and J. Anderson, overlooker. Improvements in means or apparatus for the manufacture of looped fabrics.

624. J. Miller, Upwey, near Dorchester, gentleman. Improvements in horticultural buildings and other glazed structures, part of which improvements is also applicable to ventilating other buildings.

625. E. B. Wilson, 5, Parliament-street, Westminster, civil engineer. An improvement or improvements in the manufacture of steel, and in the apparatus employed therein.

627. J. Howie, Hurlford, Ayr, North Britain, coal master. Improvements in the construction of the crossings of railways.

630. C. Clay, Walton Grange, Wakefield, York. Improvements in chain harrows.

631. J. Morris and T. Newton, 200, Upper Thames-street, zinc workers. An improvement or improvements in refrigerators and other like articles.

632. W. H. Buckland, Barge-yard, London, gentleman. Improvements in the mode of, and in the apparatus for, producing gas for illuminating and heating purposes, parts of which improvements are also applicable for increasing the illuminating and heating power of ordinary lighting gas.

Dated March 6, 1863.

633. M. Jourdin, Manchester, chemist. Improvements in machinery for engraving by means of electricity.

634. A. Cuthell, Skerton, Lancaster. Improvements in self-acting dampers for steam-engine furnaces.

635. A. W. Makinson, Westminster, civil engineer. Improvements in locomotive and stationary engines.

638. G. T. Bousfield, Loughborough-park, Brixton. Improvements in the manufacture of illuminating gas, and in apparatus employed therein. (A communication.)

639. D. W. Ransom, 24, Pembroke-place, Liverpool. Improvements in fixing artificial teeth.

640. T. Hancock, Birchwood, near Alfreton, Derby, colliery manager and coal merchant. An improved receptacle for gold or other coins.

642. T. G. Webb, Manchester, glass manufacturer. Improvements in the manufacture of articles of pressed glass.

643. A. V. Newton, 66, Chancery-lane, mechanical draughtsmtn. An improved construction of elastic carriage wheel. (A communication.)

644. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the construction of metal casks, and in the machinery employed in the manufacture thereof. (A communication.)

Dated March 9, 1863.

646. R. Mushet, Coleford, Gloucester, Metallurgist. An improvement in the manufacture or treatment of pig or cast iron.

650. J. Haworth, Manchester, gentleman. Improvements in breaks for omnibuses and other carriages.

652. W. Inglis, Edinburgh, engineer. Improvements in steam boilers and engines.

656. J. R. Gorst, Liverpool, carriage builder. Improvements in carriages.

Dated March 11, 1863.

662. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in voltaic belts and bandages. (A communication.)

664. G. A. Fulton and J. Clyde, Stepney, gas engineers. Improvements in dry gas meters.

666. H. Wilson, Watling-street, engineer. Improvements in machinery for shaping wood.

668. A. Barclay, Kilmarnock, Ayr, North Britain, engineer. Improvements in locomotive boring and winding engines.

670. J. Werge, 379, Oxford-street, dealer in photographic and scientific instruments. Improvements in apparatus for indicating any regulated maximum or minimum degree of temperature. (A communication.)

672. J. Renshaw, Manchester, machinist. Improvements in machinery for dressing, raising, and brushing silk and cotton velvets, velveteens, cords, plushes, and other piled fabrics.

Dated March 12, 1862.

674. F. Buser-Kraushaar, 2, Thavies-inn, Holborn. Improvements in apparatus for winding, cleaning, measuring, sorting, doubling, throwing, and reeling silk, parts of which improvements are also applicable to like machinery for spinning, doubling, and twisting cotton, wool, and other fibrous materials.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated March 12, 1862.

678. E. H. Lomas, Rodney-wharf, Church-road, Battersea, Surrey. Improvements in the action of charger or measure for powder flasks, canisters, or other vessels.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, March 24, 1863.

3038. W. Palliser. Construction of ordnance and projectiles to be used therewith.

3045. W. Dobson. Apparatus used in dressing lace or other fabrics.

3047. T. Bradford. Clothes wringer and mangler, applicable to pressing the liquid from clothes in the process of washing.

3056. T. C. and J. Eastwood. Apparatus for combing wool or other fibrous substances.

3057. J. Slack. Nursery swings and cots.

3057. R. A. Brooman. Apparatus for shunting trains. (A communication.)

3069. S. Roderts. Frames for containing stoppered bottles and jars.

3070. H. Morgan and J. Parkinson. Weighing machines.

3081. W. H. James. Steam engines.

3093. J. Arbòs. Generating certain gases for lighting and heating.

3094. P. H. Klein. Machinery for turning or shaping metals or other substances.

3097. C. W. Harrison. Looms for weaving.

3099. R. Brown. Warming and ventilating.

3103. L. Lenzberg. Apparatus for raising and lowering Venetian and other blinds.

3104. H. J. F. Marmet. Lamps.

3108. J. Arbòs. Generating certain gases for obtaining motive power.

3113. G. A. Buchholz. Manufacturing semolina and flour.

3120. J. W. Child. Working wool and other fibres.

3124. W. Bottomley. Machinery for stiffening woollen and other fabrics.

3127. J. Townsend. Damping and preserving vegetable and other textile materials and fabrics.

3133. C. Wagner. Strengthening, securing, and rendering more durable the soles or bottoms of boots and shoes. (A communication.)

3138. S. and C. Deacon. Tops, caps, and windguards for chimneys.

3143. C. De Bergue. Manufacture of metal reeds for weaving.

3154. E. Leigh. Cotton gins.

3165. A. V. Newton. Sewing machines. (A communication.)

3187. W. A. Waddington. Machinery for cutting wood.

3188. J. T. Caird. Steam engines.

3220. W. Clark. Apparatus applicable as a pump water meter, hydraulic motor, or a steam engine. (A communication.)

3241. A. T. Becks. Machinery for cutting or shearing sheets or plates of metal.

3249. H. Swan. Stereoscopic apparatus.

3254. G. Lewal. Hot air apparatus in cast iron or any other metal or substance, consisting of prismatic tubes, to be applied to chimneys with flues and heat conduits. (A communication.)

3263. E. B. Wilson. Railway wheels.

3314. W. A. Turner. Machinery for cutting or paring starch.

3318. I. Spight. Horse shoes.

3398. E. B. Wilson. Machinery or apparatus for forging and pressing metals and other substances.

3422. F. Parker. Carriages.

3462. J. H. Riddell. Cast metal or other pipes or tubes for conveying gases, fluids, or vapours, and in the mode of connecting such pipes or tubes.

3463. J. H. Riddell. Stoves.

3472. J. H. Johnson. Ingot moulds employed in the casting of steel and other metals. (A communication.)

3482. W. B. Adams. Railways and tramways.

63. G. T. Bousfield. Skate fasteners. (A communication.)

162. R. A. Brooman. Sulphate of soda. (A communication.)

184. A. Boubée. Casting or moulding articles in glass.

253. J. Platt. Rotary engines.

263. T. A. Weston. Coupling and break for transmitting or regulating or arresting motion.

399. J. C. Jeffcott. Production and generation of gases.

411. F. E. Walker. Breech-loading firearms.

412. J. Morgan. Embalming and preserving from decay human bodies and bodies of other animals, also pickling, curing, and flavouring animal bodies.

438. E. Strawson. Buttons which may be instantaneously attached without sewing.

489. J. P. F. Datichy. Steam engines.

505. W. Hooper. Insulating and protecting telegraphic wires and rods.

512. R. W. Thomson. Obtaining and applying motive power.

513. G. Bower and W. Hollingshead. Production and transmission of gas or other fluids.

517. F. A. Gatty. Printing and dyeing cotton and other fabrics.

527. H. H. Henson. Mats.

572. J. Penn. Escape or relief valves to the cylinders of marine and other steam engines.

579. J. W. Burton. Refining and purifying oils.

606. T. H. Morrell and J. Williamson. Purifying the noxious vapours or gases given off from night-soil or other similar substances during the heating, drying, or evaporating of such substances.

608. P. Adie. Measuring angular and actual distances.

618. W. Allen and W. Johnson. Grinding "cards" employed in carding engines.

631. J. Morris and T. Newton. Refrigerators.

638. G. T. Bousfield. Illuminating gas. (A communication.)

678. E. H. Lomas. Charger or measure for powder flasks, canisters, or other vessels.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed March 20, 1863.

2593. T. Knowles, J. Houghton, W. Knowles, and W. Houghton.
2595. W. Dobson.
2597. R. A. Brooman.
2604. R. A. Brooman.
2614. F. Tolhausen.
2615. J. Raywood.
2616. J. R. Breach and E. B. P. Smith.
2617. J. Eardley.
2618. W. Lea.
2623. T. R. Harding.
2625. J. J. Bates.
2629. W. E. Gedge.
2635. J. C. Pruvost-Bauchard.
2643. H. Hirsch.
2645. H. Ellis.
2657. P. G. Van der Byl.
2661. W. C. Cambridge.
2663. W. H. Ward.

Sealed March 21, 1863.

2334. S. J. Paris and W. Bate.
2640. W. B. Lord and F. H. Gilbart.
2648. R. A. Brooman.
2683. J. E. Billups.
2695. D. Lowe.
2703. J. Heap.
2747. T. Bouch.
2810. E. Lord.
2849. T. Greenwood.
2854. J. Turnbull.
3101. R. Beck.
3157. J. Moule.
3366. W. Tongue.
3478. W. Richards.
37. H. Bessemer.
68. A. Guild.
114. H. Bessemer.
151. J. Lightfoot.
217. W. Allen and W. Johnson.
220. M. A. F. Mennons.
300. C. Smithies and G. L. Smithies.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

728. J. Brown.
741. W. Turner.
742. G. Crawshay.
759. B. Cooper.
761. S. C. Lister.
763. G. K. Snow.
988. C. F. Sebille.
1041. R. Seager.
1915. R. A. Brooman.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

850. A. C. L. Devaux.
680. H. Brierly.
1087. A. C. L. Devaux.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending March 21, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2237	0	8	2249	0	4	2262	0	8	2274	0	4	2286	0	10	2297	0	10
2238	0	4	2250	0	4	2263	0	10	2275	1	2	2287	0	10	2298	0	8
2239	0	10	2251	0	4	2264	0	4	2276	0	4	2288	0	4	2299	1	6
2240	0	4	2252	0	4	2265	0	4	2277	0	4	2289	0	4	2300	0	4
2241	0	4	[illegible]	0	4	2266	0	4	2278	0	10	2290	1	4	2301	0	6
2242	0	6	2255	0	4	2267	1	4	2279	0	4	2291	0	4	2302	0	4
2243	0	4	2256	0	10	2268	0	4	2280	1	0	2292	0	8	2303	0	4
2244	2	0	2257	0	4	2269	0	4	228[illegible]	0	4	2293	0	4	2304	0	10
2245	0	4	2258	0	4	2270	0	4	2283	1	6	2294	0	4	2305	0	10
2246	0	10	2259	0	4	2271	0	10	2284	0	4	2295	0	4	2306	0	4
2247	1	0	2260	0	6	2272	0	4	2285	0	6	2296	0	4	2307	1	10
2248	0	4	2261	2	2	2273	0	10									

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback, 1s.

	£	s.	£	s.
Teak ......load	14	0	15	0
Quebec, red pine	3	10	4	10
,, yellow pine	3	0	4	0
St. John, N.B., yellow	5	0	5	10
Quebec oak, white	5	10	6	10
,, birch	3	0	3	10
,, elm	3	10	5	0
Dantzic, oak	3	10	6	10
,, fir	2	10	3	10
Memel, fir	3	0	3	5
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzig, fm	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	19	10
St. John, white spruce	14	10	16	10
Yellow pine, per reduced C.				
Canada, 1st quality	17	0	18	0
,, 2nd do	11	0	12	0
Archangel, yellow	13	0	13	10
St. Petersburg, yellow	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white	9	0	9	10
Gefle, yellow	10	0	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in. ,, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
PUMICE STONE. per ton	5	10	9	0

OILS, &c.

	£	s.	£	s.
Seal, pale ......per tun	48	0	0	0
Sperm body	84	0	0	0
Cod	47	10	48	0
Whale, South Sea, pale	43	10	0	0
Olive, Gallipoli	59	0	0	0
Cocoanut, Cochin	53	10	0	0
Palm, fine	38	0	0	0
Linseed	43	0	0	0
Rapeseed, English pale	53	0	0	0
Cottonseed	34	0	44	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
IRON:									
Welsh Bars, in London	per ton	6	10	0	to	6	15	0	2½
Nail Rods	,,	7	5	0	,,	7	10	0	,,
Hoops	,,	8	10	0	,,	8	15	0	,,
Sheets, single	,,	9	10	0	,,	9	15	0	,,
Staffordshire Bars	,,	7	10	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	17	6	,,
Rails	,,	5	15	0	,,	6	0	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	13	0	,,	2	17	6	,,
Swedish Bars	,,	11	10	0	,,	12	0	0	2½
STEEL:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	0	0	,,	18	0	0	,,
COPPER:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8½	,,	0	0	8½	,,
Fine Foreign	per ton	94	10	0	,,	95	0	0	3
TIN:									
English Block	pr cwt.	5	19	0	,,	0	0	0	2½
Bar	,,	6	0	0	,,	0	0	0	,,
Refined	,,	6	4	0	,,	0	0	0	,,
Banca	,,	6	5	0	,,	0	0	0	nett
Straits	,,	6	1	6	,,	6	3	6	,,
TIN PLATES:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	3	0	,,	1	4	0	,,
LEAD:									
Pig, English	per ton	20	15	0	,,	21	10	0	2½
Spanish, Soft	,,	20	7	6	,,	20	10	0	,,
Shot, Patent	,,	23	15	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	27	0	0	,,	0	0	0	,,
SPELTER:									
On the spot	,,	18	2	6	,,	18	5	0	nett
ZINC:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
QUICKSILVER	pr btl.	7	0	0	,,	0	0	0	3
REGULUS OF ANTIMONY:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,

4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, APRIL 3, 1863.

RIFLED AND SMOOTH-BORE GUNS.

THE experiments at Shoeburyness on Captain Inglis's gun-shield furnished results which gave rise to some interesting comparisons between the effects of rifled and smooth-bore guns. On this subject a practical artillerist has furnished us with data and calculations on some points of interest which it is desirable should be submitted to public discussion. He takes as the basis of his calculations the effects produced by projectiles fired from three guns—namely, a Whitworth hexagonal 148-pounder, an Armstrong spherical 100-pounder (smooth-bore), and a Lynall Thomas rifled 150-pounder. Each shot was fired with a charge of 25 lb. of powder, and their respective impact velocities, in the order we have named them, were reported to be 1240, 1470, 1150, but we believe the last was 1215 feet per second. Our informant states that the shooting on the whole gave results very much in favour of the rifled guns. The values of the impacts being in proportions as follows:—

Whitworth rifled	100-pounder smooth-bore	L. Thomas rifled
17·08	14·99	18·34.

The effective forces, measured by multiplying the weight by the square of the velocity, he states to be:—

Whitworth	100-pounder	L. Thomas
21·06	22·13	22·29.

The windage of the three guns he estimates thus:—Whitworth, *nil*; Armstrong, 100-pounder, almost nothing; L. Thomas, ·092, which last is said to be an "enormous superiority."

On these calculations we will make some remarks. The value of impact cannot be determined unless the diameter of the shot, the material of which it is made, the quality and thickness of the plate, and the backing of the plate are the same. A cast-iron shot will make a deeper indent than a wrought-iron shot, but the effect of the former will be less damaging, because the metal breaks up at the moment of impact. The momentum is divided amongst the fragments, many of which recoil from the mass without coming in contact with the plate, consequently the projectile does not produce its maximum effect. The results with a hardened wrought-iron shot would be somewhat similar. A softer and tougher wrought-iron shot would make a less indent, and have less penetrating force; but its smashing effect would be greater, because, remaining entire or nearly so, the momentum of the mass at the moment of impact would be concentrated. A tough steel projectile would be superior to all.* If one shot be smaller in diameter and the work done (measured by the weight multiplied by the square of the velocity) be the same, the smaller diameter will produce a greater indent than the larger, by the reason that the same force is concentrated in a smaller area. If one plate be thinner than another, or the backing to one be a yielding and to another a rigid material, the indent, in each case, will be greater in the former than in the latter.

With reference to windage, we have to take into account the discrepancy between the bores, which disturbs fair comparison founded on similar charges of powder. Every gun is made to produce its maximum effect in its normal condition, which consists in a systematic and proper apportionment of strength of the gun, diameter and weight of the projectile, and charge of powder. Alter either of the two latter conditions, the gun loses a part of its calculated effect.

Armstrong's 100-pounder was fired with 25 lb. of powder, its service charge being 33 lb. This was a disadvantage; and yet its superiority to Whitworth's was as 22.13 to 22.06, and it only differed from L. Thomas's as 22.13 to 22.29.

The statement that the windage of the Lynall Thomas gun was greater than that of the 100-pounder, does not rest on a sure foundation. The exact windage of his gun is given as .092 inch. It could be measured, but that of the 100-pounder could not—at all events, it was not, and is stated to be "almost nothing," because the fit to the bore was so close that the shot was with difficulty introduced into the gun. But this does not prove the windage to be less than .092, it may have been more. The difficulty of turning a perfect sphere is well known. The slightest deviation from the spherical form at one point, might render it difficult or impossible to ram the shot home, and yet there might be a large amount of windage at other parts. A cylinder can be turned with perfect precision—so true as to make a close fit all over. The Whitworth shot are only partially hexagonal. They are not now intended to be a close fit. The angles of the hexagons on the shot are removed, but they remain in the rifling. Hence the open spaces at every angle cause a great amount of windage. We are told that the friction in the mode of rifling the Lynall Thomas gun is reduced to the minimum, and the rifling itself is of a form to come out of the gun as true as a die. Hence there is absolutely no deflection, and the superior results are accounted for. We are not prepared to gainsay these statements, but they remain to be proved by a series of experiments.

As to the form of rifling, it does not alter the character of a rib in relief on the bore. The rib has to resist laterally the whole force of the pressure of the grooved shot in twisting out of the gun. This pressure is constantly on one side of the rib, wearing it away, and tending to force it off the face of the barrel.

Some time ago Mr. Anderson (of Woolwich) made a course of experiments to ascertain the strength of different forms of rifling. These, it is asserted by our correspondent, tended to show that the Lancaster was the weakest and the Thomas the strongest, the latter being the only one which broke the machine in the attempt to destroy the grooving. This mode of testing the strength of systems of rifling with a machine is fallacious, it is not the right mode—it is not the same as explosive force. The resistance of a rib, in the rifling to pressure on its top, from within the gun outwards, would differ essentially from lateral resistance of the rib to the friction of the shot when the gun is fired. No doubt, a steady force pressing on the rib, such as that of a wedge driven into the muzzle of the gun, would encounter great resistance from the rib in relief, more resistance than from a grooved or an oval surface; but that kind of resistance is not the same thing as resistance to the explosion of gunpowder which searches out the weakest place and will find it. Of all systems of rifling, or of boring guns to produce the effect of rifling, we cannot but think the oval bore must be the strongest, because it deviates, in a small degree only, from a circular bore, is a continuous curve, and requires no lines or grooves to be cut into the metal. It is, in fact, an oval smooth bore.

We do not make these remarks in a controversial spirit. Our only object is to elicit the truth; and we make no doubt, as the points referred to are of moment with reference to the best class of great guns, and the best form of rifling, they will be fairly discussed by the advocates of the various systems, which the important experiments about to take place will soon bring before the public.

TRACTION ENGINES.

WE once, foolishly we admit, believed that the days for sumptuary laws had passed away, but truly "old things become new;" and as Queen Mary passed laws regulating the width of the toes of her subjects shoes, so does our own Government pass laws regulating the breadth of our wheels; doubtless, both laws were enacted from equally good reasons. Mary's subjects submitted quietly enough, we dare say. "That was the law," and that was enough for them; but, unfortunately, engineers as a class are so much accustomed to demand a reason for everything, that they demand a reason for the very laws which touch on their profession or interfere with their manufacture; and although Mary's subjects might submit quietly enough, engineers of the 19th century will feel little disposed to bow to a law calculated to do them an injury, and interfere with a branch of their business growing daily of more importance.

The 3d clause of the "Locomotive Act," says that "every locomotive drawing a waggon or carriage shall have a breadth of not less than 9 in., and the wheels of every locomotive shall be cylindrical or smooth soled," under a penalty of £5 for every day any engine infringing such Act shall be at work. From this, we see that we are compelled to adopt a tyre, not less than 9 in. wide, without roughness or projection, gap or opening, and this law is sweeping, minute, and absolute. An Irish barrister once said that "he could drive a coach and four through an Act of Parliament." It is quite certain that, were he now alive, he could not perform the same feat with a traction engine; we scarcely wish to assert that the law is unjust, illiberal, or injurious in its tendency, not only to the country at large, but to a very large class of enterprizing individuals. We prefer rather to place facts before our readers, and ask them to judge for themselves; and in this spirit we will try to show the precise bearings and effects of a clause, to which we wish to attach no epithet, and in as few words as may be.

Most, if not all, of our readers are aware that the wheels of a railway locomotive are made of iron, generally wrought, in a few rare instances cast iron. The best material for the wheels of a common road locomotive also is wrought iron; wood has been used, but quickly becomes unserviceable; cast iron is unsuitable from its great weight, induced by any attempt to make a serviceable wheel. Wheels are, it is true, made partially of cast iron; but we believe that both purchasers and builders will, ere long, find it their interest to make their wheels almost wholly of wrought iron.

Now a 6 ft. driving wheel for a road locomotive, is a very different affair from a 6 ft. driving wheel for one of its brethren of the rail. In the latter, the width of the tyre is small in proportion to its thickness; and from the mode of manufacture, rendered necessary to secure great accuracy of shape with the maximum degree of strength, its expense is very considerable—so considerable, indeed, that any attempt to construct the wheels of a traction engine even on a modification of the same principle is quite out of the question.

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* Experiments at Shoeburyness by the Ordnance Committee, reported since this notice was written, prove the greater penetrating force of steel over cast or wrought iron projectiles. Several shots made of a tough and hard steel by Messrs. Makin and Sons, of Sheffield, which were fired at a "Warrior" target, penetrated a 4½ in. plate, and caused an indentation nearly 50 per cent. deeper than either the wrought or cast iron missiles, and produced a much greater effect on the target generally.

The wheels for a road locomotive are different in every respect; in these, we require a very broad tyre to suit the comparatively soft road; rigorous accuracy of construction is unnecessary, and would be useless; in consequence, a totally different mode of construction is adopted. Instead of welding together the component parts of the wheel under the steam hammer, as in the railway locomotive, the wheels of the traction engine are almost invariably built up, piece by piece, and fastened together by rivets; a mode of construction found safe, serviceable, extremely convenient, and sufficiently economical.

We have already stated that the tyres of such wheels are thin; and overhanging the spokes, as they do at each side, from their great breadth, it is obvious that a few days' use would render them polygonal rather than circular, as the rim would flatten between the spokes; in order to avoid this, strengthening pieces, or "strokes," as they are termed, are fixed round the outside of the tyre proper. The general arrangement of these strokes is a point on which much difference of opinion exists; the best practice places them in two rows, side by side, round the wheel; they are made in lengths, generally of about 2 ft., and from 3 to 5 in. wide, and are of course firmly rivetted together on the tyre. Not only do these strokes then strengthen the tyre, but they also serve the scarcely less important purpose of protecting it from wear; they are themselves easily replaced when worn out, while replacing a tyre is rather a serious undertaking. The general practice is to leave a space of about 3 in. between the ends of these strokes, such spaces proving of the utmost value in retaining the clips or spades put on when the traction engine has to cross turf, which smooth wheels can hardly accomplish.

Now it is scarcely possible to construct a suitable wheel, lighter or more cheaply than the one to which we refer, but the Locomotive Act renders the use of such a wheel absolutely impossible, if the law be vigorously enforced, unless the proprietor feels disposed to pay £5 a-day for the privilege; and the worst and most injurious characteristic of the clause is, that it will accept no equivalent for the 9 in. of smooth sole. In one of Hogarth's pictures, we see an electioneering party bearing a banner with the inscription, "Give us our eleven days;" the authors of Vic. 25, cap., exclaim, with equal pertinacity, "Give us our 9 in.;" it will not suffice that we may have even double the area of tyre surface resting on the ground at one time. According to the framers of the bill, two 7½ in. tyres are far more injurious to the road than one 9 in. with a double load; and the effect of this is, that as a single 9 in. stroke will not effectually protect a 12 in. tyre. Besides greatly increasing the first cost of construction, builders of this class of engine must either submit to have cast-iron tyres, or use wrought ones of great thickness, costing about three times as much as would otherwise be necessary.

We have not yet alluded to the question of adhesion. We believe that the bearing of the bill on this part of the subject is of even greater importance than on the practical difficulties and annoyances entailed by its rigid enforcement on the wheel-maker, little, perhaps, in themselves, but great in the aggregate.

We have no doubt that the framers of the clause intended to prevent injury to the roads. They may feel surprise when we inform them, that there is nothing so likely to injure a road as a smooth wheel; its capabilities for doing mischief far exceed that of the rough wheel in general work; the reason is obvious enough. The only injury a traction wheel can do to a road, apart from that common to the rolling action of all wheels, is by slipping. It is evident enough that so long as a tyre is so moderately loaded in proportion to its bearing surface, that it does not sink into the road, that its rolling action can do comparatively no harm; but so soon as such a wheel begins to slip, it will cut, or rather grind away the road.

It is quite as much the wish of the engineers to avoid this slipping as it is the desire of the legislature to prevent the consequent injury to the roads; but instead of permitting the use of a rough surface, to prevent this slipping, and consequent abrasion, the latter compels the former to resort to a smooth wheel, which exerts an attracting action almost continuously. Be it remembered, that we do not for a moment advocate the use of spikes, spades, &c., on our highways; such means of obtaining adhesion are, except in a very few cases, not only unnecessary, but positively inapplicable, whatever theorists, who are only acquainted with the road locomotive on paper, may imagine. Half-a-dozen semi-spherical steel rivet-heads projecting half or three-quarters of an inch from each square foot of the tyre, will give an ample amount of adhesion for all ordinary purposes; wheels so provided, 12 in. wide, and each loaded with 3 tons, possess quite sufficient adhesion to draw 20 tons up an incline of 1 in 15 or 20 without slipping, and will injure the road so little that they will scarcely leave a mark to show where they have gone; it has been urged that the use of all such projections must dig up the road on the same principle as the rotary digging machine; such an assertion is simply absurd; did the wheels slip they would certainly injure the road more than a smooth wheel, but such roughness effectually prevents slipping; and so long as a wheel with projections of such moderate length continues to roll, it can do little injury; indeed, we must recollect that the road is not smooth; on the contrary, every part of it is rough, and full of inequalities; and into these hollows and inequalities, such projections as we speak of fit without necessarily injuring the road in the slightest degree.

We do not pretend to assert that traction engines are absolutely harmless; we do not wish to maintain, with some, that they actually improve a road; but we maintain that, for the transportation of heavy goods, at moderate speed, they exert a far less injurious action; it is easy to see that a cavalcade of fifteen or twenty horses with spiked shoes must do more damage to a road than a broad wheeled traction engine transporting the same load, the projections on whose tyres need not be greater than those on the horses' shoes. So far from digging up the road, these projections make but a slight indentation; with a properly smooth wheel the case is different; such wheels slip almost continuously, and being always as heavily loaded as possible, in the attempt to obtain adhesion, woe to the road on which they are at work. We have seen a furrow ten yards long left by such a wheel, where a rough one would scarcely have marked the place where it passed.

We thus see that this clause is calculated to defeat the end it had in view by its framers, and that it bears so injuriously on the construction of this class of engine that it amounts almost to a prohibition of their use, and prevents in consequence the further development of a principle likely to add very extensively to our resources of transit. We believe that the matter only requires to be placed before the public in its proper light, to obtain such a readjustment of the existing law as will prove satisfactory to all parties.

INSTITUTION OF NAVAL ARCHITECTS.

The ordinary meetings of this institution took place last week in the large hall of the Society of Arts. A large number of members, associates, and friends were present. The Right Hon. Sir J. Pakington, occupied the chair.

The following is merely an abstract of some of the principal Papers read and discussed. On Thursday morning four Papers were read in succession upon the great subject of iron-clad ships—by Mr. W. Fairbairn, "On the Construcof Iron-plated Ships;" by Mr. Samuda, "On Iron-plated Ships;" by Mr. Scott Russell, "On the Present State of the Question at issue between Modern Guns and Iron-coated Ships;" and by Mr. E. J. Reed, of the Admiralty, "On Ironcased Ships."

Mr. Fairbairn's Paper had reference chiefly to the importance of the working of the iron, and the methods of obtaining the greatest mechanical strength. As a rough statement it might be said that thickness of plate would represent strength, but much depended upon the processes of hammering and rolling, by which the fibre and texture of the metal were improved. He recurred to the views he had expressed in former Papers, which were founded upon many experiments, and said that the cellular structure employed in tubular bridges and girders was the best form for obtaining greatest strength. He advocated the use of this principle in the construction of iron ships, and would have the cellular compartments run the whole length of the bottom and sides of a ship, her armour plates to come above this, and the decks to be made very strong means of support by making the beams of iron. A ship ought to be so stiff that she would bear suspending on two points, one at each end, or even upon one amidships. As to steel, it was difficult to say what might not be done with it, as its strength was much greater than that of iron; still, as yet it had not been sufficiently tested. He was not inclined to building very large ships. He showed a diagram of a vessel in which he would arrange the heavier burden of engines and guns in the middle, and these to be protected with more extensive armour-plates, while a belt might be carried round the ship at the water-line, covering the steering apparatus and screw, but leaving parts unprotected. As to large guns, he was much of opinion that the limit of their strength had been attained in the 300-pounder.

Mr. Samuda's Paper commenced by stating that an efficient navy was and must always be of the first importance to this country, and that no navy could be efficient except it be armour-cased, in order to meet all artillery that might be brought against it. Partial protection was no longer upheld as a necessity, and entire protection, in deference to a strongly-expressed opinion of its necessity, had been substituted in all the vessels that had since been commenced. Entire protection, the greatest speed obtainable, armour which admitted of the easiest replacement, and, lastly, which added strength to the vessel by being incorporated into its structure. Those four points could not be too frequently urged as indispensable to an efficient iron-clad navy. Although he held that plating wooden ships in armour was but a make-shift, and that real service and bad weather would lay bare the fallacy of expecting it to be anything but a temporary job, yet he felt it was satisfactory to know that some proper amount of protection was about to be given to the country, even though it should be limited to the Government dockyards. He could not help expressing the surprise and indignation he felt, in common with other leading shipbuilders, who had all contributed most loyally to advance the success and welfare of the navy, and who had not hesitated to place themselves and their establishments at the disposal of the Government without any adequate profit, when the construction of the iron navy was of imminent importance, to find themselves referred to by the Controller of the Navy and the Admiralty in terms of censure and reproach, as a reason for the asking Parliament to give back to them the privilege and patronage of again building in their dockyards vessels which had far better have been built of iron than of wood, and in private instead of in public dockyards. The period had arrived when they must consider whether any and what general improvement in the character of those which would have to follow should be adopted, and a consideration of the relative advantages of portholes and cupola ships would lead to the solution of that important question. The cupola reduced materially the weight of armour required to be carried on the top sides of the vessel. If 4 ft. be fixed in both cases as the extent of under-water protection, the cupola vessel only required a total depth of armour of 11 ft. against 20 ft. for the porthole. The 11 ft. gave perfect protection to the cupola vessel, while the 20 ft. only yielded partial protection to the other, every porthole being assailable by shot and shell. The next advantage was the facility of working very much heavier guns, the advantage of moving them mechanically, and the very much greater range obtainable rendered every gun in a cupola ship at least equal to two worked in a porthole ship, and in many instances to much more. Another advantage was the concentration of the crew, and their extra protection in all circumstances. Also the rolling of the vessel would interfere with the working of the guns, where they had to be fired from ports, long before it would have reached a pitch to prevent working them in cupolas, and where they were fixed from over decks; and, lastly, the power which that mode of keeping down the tonnage of the vessel, and at the same time obtaining a high velocity, was of the greatest importance. The importance of obtaining that result at an early period was what he desired; and if he could sufficiently engage attention to the importance of that conclusion, he should have obtained the object he had in view in writing that Paper. The "Prince Albert" was an excellent beginning, having many advantages, but it should have 800-horse power instead of 500, and that change would make it a 13-knot ship, and much improve the character of the craft. He suggested that the Admiralty should build five additional "Prince Alberts" in private yards at the same time they were proceeding with the five porthole frigates in the dockyards. The cost of the whole of those vessels would be only £1,000,000, and he was sure the House of Commons would vote it for such an important object. The result, he believed, would be that the cupola ships, far from being useful only for coast defence, would be found serviceable all over the world.

Mr. Scott Russell reminded the society that they were considered heretics two years ago for advocating iron ships. The question had progressed since then, and now the demand for the new navy was for ships with great speed and immense strength. They must be 14-knot ships; they must be long to have speed, and broad to have stability, and keep their ports 9 ft. out of water. He put the case of there being an "Alabama" upon the track of our China and Australia trade; he would not call her a pirate, but supposing such a ship in time of war, we had only two ships that could chase her—the "Defence" and the "Resistance," would only follow in her wake. We saw the whole available American navy engaged in trying to catch this "Alabama." Mr. Russell would do away with the timber-backing of the "Warrior," and substitute iron plates. It did no good; it only caused buckling of the plates, tending to draw out the bolts, and took fire with shell, as we saw at Shoeburyness. The weight of this wood would be better exchanged for iron plating. Mr. Russell gave Mr. Pole's formula for the relative strength required for plates *versus* guns. For—

68 pounder	4½	inches
130 „	6½	„
200 „	7½	„
290 „	8½	„
400 „	10½	„
500 „	11½	„
600 „	12½	„

We have now to provide against a 300-pounder sending shot with a velocity of 1,500 ft. per second, and we have to mount and fire this gun rapidly and easily to the ship ourselves. He could not but think that this would be done with all the able mechanics and engineers the country possesses. Captain Coles's cupola he had made himself, and this one had been tried successfully. The turntable was the only mode he knew of which enabled such heavy guns to be moved with so much ease; and by this means, too, the weight was kept in the central line of the ship. The "Prince Albert" he could not think a judicious application of the principle, and the "Royal Sovereign" was much worse. But give any one of our gallant naval officers a 15-knot ship, with a cupola forward and one aft, and the engines and rudder shot-proof, and he would be bound they would give a good account of any "Alabama" in the world. But if it was required to work guns even on the broadside by machinery, it was only to say so, and there were plenty of mechanics who could do this. Mr. Russell intimated that he knew how to make a larger number of guns available than in a cupola. He could see how the 300-pounder broadside gun could be put on a par with the turntable 300-pounders. The portholes in the cupola have the great advantage of being small, but it would be quite practicable to work a 300-pounder at any elevation in an opening which shall not be larger than the muzzle, only sufficient to allow of aiming. As to weights of armour, he would expect to see used 7½-inch plates, with 3½-inch iron backing, in vessels 500 ft. long and 70 broad, of 12,000 or even of 22,500 tons—"Great Easterns," in fact, 700 ft. long and 83 broad. Mr. Russell pointed out that the "Hector" and "Valiant" are not proof against shell at unarmoured parts; they would be blown up by shell entering here. But we must adopt expedients of partial protection and partial battery. The "Warrior" has more iron in her than the "Great Eastern," in consequence of it not being used with economy. Protection to the waterline he did not much care about, as the water-tight compartments serve the purpose of protection. He attributed much to the labours of the Iron-plate Committee, and looked to next year to show us how much progress had been made in scientific knowledge and professional acquirement, and ended by saying that engineers and naval architects were ready to serve the Government, and to put up with loss rather than the service of the country should suffer.

Mr. Reed then followed with his Paper, which, after a few observations alluding to his having resigned his office of Secretary to the Society so as to avoid embarrassing them, referred chiefly to a defence of his plan of construction adopted in the "Enterprise" sloop of 950 tons, and an attack upon Captain Coles's cupola plan. His iron-cased ship was as unlike the "Monitor" as possible; it was well out the water, well supported at every part, the armament in the centre, of few guns of long range, with the steering apparatus and engines protected by proof armour. He would armour-plate every ship of every size to a certain degree, giving them large guns with long range and high speed. Anything like the "Monitor" would be a decadence, a disgrace to our pride and to the "flag that has braved the battle and the breeze." The form of our ships should never be compromised as it is in the cupola plan. They must have good handsome masts and rigging. He advocated wooden ships, and especially wooden bottoms in small ships particularly. But if 14-knot ships must be had, then iron is the only material to make them of; and this was according to the first design he had the honour of submitting to the Admiralty. He stated the evidence of the Surveyor of Lloyd's, that in some iron ships not five years old 1,000 rivets had disappeared in the bottoms. And in private yards he knew of the plates being joined so badly as to require caulking, as the records of the society, he believed, would show. Still he would not deny that now no labour or capital is spared in private yards, and a high degree of excellence is attained. Mr. Reed described the "Enterprise," and said the frame of this ship was of timber converted. She had her battery in the centre, in a water-tight compartment, with means for fore and aft firing of the guns. In the "Renard" and "Favourite" the iron upper work was avoided, and they were completely plated. He alluded to the severe criticisms his plan had met with from the press, and especially from Admiral Halsted, defending the "Enterprise" from the charges brought against her in that gallant officer's pamphlet. As to the cupolas, or turrets rather, of Capt. Coles, they were exposed on at least 10 ft. square on all points. The trials with the "Trusty" in 1861 he thought not conclusive, as breech-loaders were used. Then these cupolas could be easily wedged by boarders. He could see no prospect of such vessels being made sea-going, and in action, as the bulwarks are permanent, the guns could not be fired fore and aft. By an array of figures on the black board, Mr. Reed showed that the statement in the Mechanics' Magazine, 27th February, as to the weight of broadside being in favour of the cupola, was not only erroneous, but that the advantage was largely in favour of the "Favourite." Guns of 20 tons he expected to see worked by machinery, and if we disponsed with these 120-ton turrets we could afford to use machinery. Small shield ships could not be constructed; and as to the ships now proposed by Captain Coles, it was impossible to construct them as designed. Rapid turning of a ship with broadside ports like the "Favourite" would be gained by using the double-screw system and high speed; experiments upon which had recently been successfully made by Captain Astley Cooper Key. He did not regard the "Enterprise," "Resolute," and "Favourite" as specimens of the class of ships he conceived would become the future style of naval architecture.

Mr. Fairbairn stated that he had proposed in 1855 to the Admiralty to investigate the subject of iron plates for ships, but was not encouraged to proceed.

Admiral Halsted, in reply, admitted that he was mistaken as to the statements in his pamphlet about the "Research" having the iron box, as he called it, or rectangular cupola. He protested, however, against being provided with these ships-of-war, one-third of whose guns were useless, and maintained that no trials had ever been made of targets representing ships' sides until the ships were in progress of construction. The Whitworth shell, fired upon a target stronger than the "Minotaur," in November last, had initiated a revolution in naval gunnery and shipbuilding, and henceforth it was shell that was more difficult to keep out than shot, for it penetrated with more facility than solid shot.

After the discussion, Mr. Lancaster, the well-known artillerist, stated, in reference to the future use of very large ordnance with shell, that he had seen in America lately 400-pounder shells, of cylindrical form and hollow-headed, fired from an 18-ton gun, which pierced plates of 9 in. thick at long ranges. These guns were used in turrets, to which was attached a lower and smaller turret, in which the loading of the gun was managed by the crew of the gun; and this was much facilitated by using a small tramway, on which the gun worked.

At the meeting of the Institute on Friday, Sir J. Pakington in the chair,

Captain Cowper P. Coles described his plan of turret ships, especially comparing with the "Favourite" (a vessel on the plan of Mr. Reed), his own design, called the "Naughty Child," being a ship of the same length, beam, and tonnage, and of equal power, speed, and draught of water. In the "Favourite," the guns are at the two sides of the vessel, and are placed in a protected battery amid ships, having a very limited range, and being in danger of dipping into the sea on the roll of the ship. In the "Naughty Child" he proposed to place a smaller number of guns—say three in two cupolas—which guns, from the facility of turning round the turret, would be as effective as a broadside twice the number. In the cupola, also, he had the advantage of keeping the gun pointed in the right direction, so that no time was lost after loading, but fire might be delivered at once. The same facility existed for keeping the guns pointed at an enemy while manœuvring the ship; while, in case of boarders, he could fill the spaces between the masts and stays with riflemen, as well as the tops of the turrets. The danger of the turrets being damaged by shot was not great. Sixty-nine shots were fired at the Trusty, by the best gunners in the navy, and only 44 hit the cupola. It was a great advantage of this plan, that by it guns could be trained and loaded at the same time. He read an extract from an account of a recent fight in America, showing that no injury had been sustained by the turret ships, although in one case the turret had been hit sixteen times, and that the guns were perfectly manageable. He said that the danger of wedging the cupola was small, and he thought little difficulty would be found in knocking out the wedges if the enemy succeeded in driving them in. He contended that the proper vessels for us would be shield-ships, with a belt of armour reaching five feet above and below the water-line, armed with a small number of heavy guns in cupolas.

Mr. Reed objected to estimating the force of a ship by the weight of its broadside. Round shot should not be compared with elongated projectiles. At Shoeburyness the 150 lb. round shot produced nearly the same effect as the 300 lb. elongated. It was not fair to deceive the public by such comparisons. He hoped that this discussion would have the effect of making gentlemen careful that their facts should be unimpeachable.

Admiral Halsted asked how a broadside ship such as the "Favourite" could be defended as well as a cupola ship like the "Naughty Child," without using double the number of guns to produce the same effect.

Admiral Sir E. Belcher said that in the "Naughty Child" the guns were not in the centre of the turntable, and when the guns were on the lee side they must tend to prevent the ship from righting herself, while the guns on the two sides balanced each other. He had proposed a plan of three guns on one turntable, each placed at right angles to the radius, so that the recoil of one gun would bring the other into position.

Mr. Prideaux sketched on the board the outline of a plan he had submitted to the Admiralty of a ship which appeared something like the cigar-shaped vessel they were building in Liverpool some years since.

Captain D'Orsay said draught of water was an element of little importance in the inquiry. We should build the best ships, no matter how deep they were. The effect of weight depended on its distance from the centre of gravity. Now the guns in the turret were nearer that centre than those on the broadside. Another great advantage was that they could be fought at longer angles, having a range all round the ship. In rigging, it was well known that the more rigid and unyielding it could be made the better, and he thought the tripod masts a great improvement.

Captain Scott said that a cupola ship must be unequally trimmed if she wants to give full effect to her broadside. The loss of a few plates of armour would throw the vessel up on the side next the enemy, and elevate the guns out of range. He did not think that the turrets allowed room to work the guns, and on the whole considered the plan of the midship battery the best.

Mr. Scott Russell said we should not pit the vessels against each other, but build both, and put them each to its right purpose. There was not really much difference between the two ships; both could carry armour on the water-line and for 5 ft. above it. Captain Coles placed the remaining spare weight in his ship in the form of cupolas, &c., and Mr. Reed placed it in that of a battery amidships. Were the cupola and guns heavier than the battery and guns? He thought they were at least as heavy. The heights out of water must be equal. The form most favourable for Coles's plan was a vessel with only two cupolas, which was as to these conditions on a par with Reed's ship. Then the differences were, that the latter could fight both sides at once, while the cupola ship should turn round her guns. To balance this disadvantage, Captain Coles could train his guns while loading, and could keep them on an enemy while moving. This was a great advantage. When he came to consider a vessel with a greater number of turrets than two, he thought the broadside ship had the advantage, but he said we ought to build both kinds, and do our best.

The Chairman said he must congratulate the society on their having held a very interesting and instructive discussion, which had been conducted with great good humour. He would not presume to express an opinion; but he thought the case was like what happens in many families, where the favourite is apt to be a naughty child. He called attention again to the tripod masts, which he considered a great improvement, as with rope rigging it was only at the weather side that it acts, while on this plan the one side was a stay, and the other a prop.

This closed the discussion on the shield-ships.

The concluding meeting of the members of the Institute was held on Saturday, the President, the Right Hon. Sir J. Pakington, Bart., M.P., in the chair.

Mr. Scott Russell read a Paper on the "Education of Naval Architects in England and France." He commenced by comparing the state of naval architecture in England and France, and the means taken by the Government of the latter country to found, foster, and encourage a naval school of architecture, which had been found to work with the most admirable results. Little had, he said, been done in England to take the best means of educating men for that science; and it was only after considerable outward pressure some years back, that the Government had decided in founding a Naval School of Architecture. This was done, and a few students admitted; but in 1853 it was abolished by Sir James Graham, who was at that time First Lord of the Admiralty. It might naturally be asked how this had occurred, which could very easily be answered, as it was found that the Government had broken faith with the students of the school in every particular; and they discovered, after having made a sacrifice of some years of study, and made themselves efficient naval architects, that the Government declined to employ them, and there was only one instance in which the Government had given proper employment to one of the pupils, while all the rest who were competent naval architects were sent to the different dockyards as supernumerary draughtsmen. This was not in consequence of a want of scientific knowledge on the part of those gentlemen, as they all bore certificates of competency; in fact, the pupils of the School of Naval Architecture, although their talents had been to a great extent ignored by the Board of Admiralty, had since, by their own exertions and scientific knowledge, all obtained high positions as naval architects of the first class, and to them was due the credit of altering the sailing fleet into a steam one in a short space of time in a pressing emergency, by that fully repaying the cost of their education. In the case of those pupils of the school, Messrs. Chatfield, Crease, and Reed had written a report which he considered as a model of systematic naval architecture at that date. Those gentlemen had been given a chance to show what they could do; and the vessel they built, although their first, had every quality for which it had been designed. He then gave an account of the great progress France had made during the last ten years, both in the science of shipbuilding and manufactures, in which up to the present time we thought we were supreme, and instanced the way in which a great French Steam Navigation Company had driven the Peninsular and Oriental Company out of the Mediterranean trade, and had in addition commenced an opposition by running magnificent vessels to China. He also mentioned as a fact that the Belgian locomotives had not only shut out the English ones from the continental markets, but that they were now brought over to England and undersold the English manufacturers. He concluded by regretting that at the present time the English were obliged to go to France to receive what he considered the requisite education on naval architecture, and strongly advocated the formation of a school or college of the kind, assisted by the Government, and explained the way in which it could be carried out.

Mr. Chatfield spoke, as one of the pupils of the School of Naval Architecture, of the efforts which had been made to put the school in the position it should occupy in this country, which were foiled and annihilated by Sir James Graham, who put them all aside for the purpose of introducing Sir William Symonds as Surveyor of the Navy. He was, however, succeeded by Sir Baldwin Walker, who frankly admitted that he was not a shipbuilder, and his doing so was the means of placing the most competent naval architects of the abolished school at his elbow—men who thoroughly understood the subject, and whose designs were carried out, although they did not get the credit for them. He approved of Mr. Russell's plan for founding a school of instruction on the subject, and agreed with him as to the necessity for it. He at the same time denied that any very great credit was due to the French for any designs sent to this country, as they had not been adopted. In fact, their pupils were in the habit of coming to the English dockyards for instruction in their profession, and often went back as competent architects, having carried with them the ideas of the practical men of our own dockyards, and taking credit for the designs they had seen here as their own.

Mr. Samuda disagreed with Mr. Russell as to the desirability of establishing a college for the sole purpose of instruction in naval architecture, as he thought the education received at an English college was sufficient until they came into a practical shipbuilder's yard.

Rear-Admiral Sir Edward Belcher said he would have hesitated to occupy the time of the meeting had he not received some information on the subject during his business connection with Sir R. Seppings, Sir Wm. Symonds, and Admiral Hay, from all of whom he had acquired some valuable information, in addition to some sound practice which he had himself acquired during his professional career. He then went into the question of speed, and compared some of the old line-of-battle ships with those of the present day, and claimed a rate of speed for the "Winchester" while under sail which had never been equalled by a man-of-war steamer—namely, seventeen knots. He also mentioned the "Southampton," "Warsprite," and "President," the latter having been rebuilt after capture from the Americans, as ships of unequalled speed, which had beaten the best French vessels in all points.

After the meeting had been addressed by Dr. Woolley, Mr. Grantham, Mr. Reed, and others,

The Chairman said he was disposed to believe that Mr. Russell was right that England was not in the position that it ought to be in a scientific point of view. All countries had, he considered, gone greatly ahead, in some cases eclipsing the English, and he advised them all to follow and consider Mr. Scott Russell's proposal, and strike out and adopt, after careful consideration, some plan of the kind which would give practical effect to the views so ably laid before them, in which he would co-operate in every way in his power.

Mr. Ditchburn, M.I.N.A., then proceeded to read a Paper "On the Origin and Construction of

Her Majesty's Yacht 'Fairy,'" but after having read a portion, he, at the suggestion of the chairman, withdrew the Paper, as it contained some strictures on the professional knowledge of a chief constructor of the Royal navy who is now living.

Mr. Gladstone, C.E., read a Paper "On an Instrument for measuring the Strain on Ships' Cables;" after which Mr. W. Froude, Assoc. I.N.A., read a paper "On a curious form of differential Wave in a stratified Fluid," with an experimental illustration.

An expression of thanks having been given to the chairman before retiring, and also to the secretary, who found that certain duties he had undertaken rendered it necessary for him to resign, the meeting adjourned till the next session.

INSTITUTION OF CIVIL ENGINEERS.

At the meeting of the Institution of Civil Engineers on December 9, 1862, Charles Hutton Gregory, Esq., Vice-President, in the chair. The discussion was upon Mr. Makinson's Paper, "On some of the Internal Disturbing Forces of Locomotive Engines."

It was argued, that the lateral motion of railway trains was not attributable so much to imperfections in the locomotive engine as to defects in the permanent way, which it was difficult to keep in perfect order, from the variations in the temperature, the changes in the weather, and other causes. The tendency of the reciprocating masses to produce oscillatory motion must be relatively less than formerly, owing to the greater weight of the present engines. It was doubted whether the re-introduction of the single cylinder engine would result in any advantage, as the difficulty of starting a train with such an engine would, under certain circumstances, be insurmountable; and the effect of having only a single central cylinder would be to raise the centre of gravity of the engine, thus creating a serious objection. The late Mr. George Stephenson had endeavoured to equalize the motion, by the adoption of a three-cylinder engine which had been in use for many years on the North-Eastern Railway. In that case there was a large cylinder in the centre, and two smaller ones at the sides; but the cost and the complication of the parts of that engine prevented its general adoption. It was, moreover, doubtful whether, even at the highest velocities, there was any apparent difference in the steadiness of that engine, as compared with others in which the revolving and the reciprocating masses were well balanced. However perfectly an engine might be balanced when it left the manufactory, after it had been running for some time, from numerous causes the springs required re-adjustment.

As regarded the disturbing forces which were said to arise from the pressure of the steam in the engine, it was contended that the unbalanced pressure upon a bearing at any time was only that due to the force driving the engine by that particular bearing. If it were possible to suppose a case of a locomotive with only one wheel, such an arrangement would no doubt tend to produce sinuous motion, with a force proportioned to the distance of that wheel from the centre of gravity of the engine. But with two wheels keyed fast upon the same shaft, of such strength as not to yield appreciably under torsion, there could be no difference of pressure (of this kind) between the two sides of the engine; and that was true wholly irrespective of the number of cylinders, or of the places where they were put. An engine capable of producing 1 ton of tractive force must distribute it over the two bearings, and there would, therefore, be ½ a ton on each bearing. Even if the engine were driven by one cylinder, it was manifest it could not put a pressure upon one side of that engine which was not equalled by that on the other side at the same moment; and that there could not possibly arise any sinuous motion from the driving pressures. Referring to the disturbances caused by the momentum of the parts, it was observed that, though the force of the parts in motion increased as the speed became higher, the times through which they acted decreased; for it could be shown, that the distance, through which these forces were capable of moving an engine, must be the same for all velocities.

As to the distance which the forces spoken of ought to move an engine, it was demonstrated that, with a locomotive the crank shaft of which was making three hundred revolutions a minute, with a length of crank pin of 1 foot, producing a velocity of 63 miles an hour, and the moving parts belonging to each cylinder of which engine weighed 500 lb., the total weight of the machine being from 27 to 28 tons, there would be an amount of motion equal to only 14-100ths of an inch. And it must be remembered, that while this would be the extent of each motion, the number of such motions, as they occurred at each revolution of the crank shaft, could not increase for a given distance travelled over, although from the greater number of revolutions per minute of a high velocity over a low velocity, there would be a greater number of revolutions in a given time.

Supposing, however, that the disturbances were as great as had been represented, then a better remedy than the single-cylinder engine would be, either the plan introduced by Mr. Bodmer in 1834, and modified by him in 1841, of having two pistons in one cylinder, both the piston-rods issuing at the same end, one being made hollow to admit of the passage of the other; or the duplex engine brought forward at the late International Exhibition by Mr. Haswell, the Engineer for the Austrian States Railway Company, who proposed to employ four cylinders—two for giving a forward, and the others an aft motion. It was stated that, in the year 1836, the late Mr. W. Weallens had designed an engine with four cylinders, similar in every respect to that last referred to.

It was suggested, that the Paper would have been more complete, if, as well as pointing out the forces tending to produce lateral motion, or oscillation, the measure of the effects of those tendencies had been calculated. Taking the forces exactly as given by the author, it was remarked that the total lateral translation, to the right or to the left, in the mass of an engine by those forces, would be in one case 1-5th of an inch, and in another 1-10th of an inch; and at a velocity of 85 miles an hour, each of those forces would act during about ¼th of a revolution; and that as there were two revolutions in one second, the diagrams represented forces acting during the ⅛th part of a second. The result of this theoretical investigation had been to show, in a visible form, a series of tendencies which certainly existed, and knowing where they existed, however slight, precautions could be taken to diminish their effect. It was evidently most important to allow sufficient play between the flanges of the engine and the rails,—that they should not fit too closely. It was considered that the estimated amount of the oscillation was so slight, that any great deviation from the established form of engine could not be recommended; certainly not the substitution of a single-cylinder engine, with all its mechanical inconveniences, for the present double-cylinder locomotive.

With regard to the effect produced by the unbalanced reciprocating parts of an engine, it was thought that the 1-5th of an inch could not be accepted as the real measure of the sinuous motion of most engines. In practice it had been noticed that, even with a good road, the lateral oscillation amounted to 2 inches, and if the road was in bad order, then it would be much more. But this did not express the evil in its true form; as it was (or might be, at any instant that the flange was in contact with the rail) a question of the amount of force exerted against the rail, tending to bend the rail, or to break the chair. As to the balancing of the reciprocating masses, direct trials were required to show the alterations necessary to be made in the positions and weights of the parts, before the best result could be arrived at. There were many objections to a single-cylinder engine, besides the difficulty of starting the train. Among these, the irregularity in the tractive power, in place of a somewhat distributed force, was alluded to, as being likely to cause a jolting action, which might give rise to accidents, from the fracture of the couplings; and it was shown that, when using full steam throughout the stroke, the maximum and minimum rotary power of the double-cylinder engine varied in each quarter of a revolution of the cranks, nearly in the proportion of 14 to 10, whilst in the single-cylinder engine the variation was as much as 20 to 0. It was suggested that the most uniform rotative power would be obtained by using two cylinders, and cutting off the steam a little before and a little after the half stroke. Further, it would be a great improvement, if locomotive-engine builders, in common with marine engineers, would use steam-jackets, both to the cylinders and their covers.

It was believed that the discrepancy between the amount of the lateral motion produced by the disturbing forces as calculated and as found in practice, arose from the circumstance, that the theory was based upon the supposition, that the wheels were without flanges. When the direction of the course of an engine at a high velocity was suddenly altered by any disturbing force, the undulation of the engine brought the flanges into violent contact with the rails, and the elasticity of the rails caused the engine to rebound, or rather glance off, against the opposite rails. When the rebound happened to be simultaneous with a disturbing force acting in the same direction, the maximum oscillation was caused; but the rebound was in some degree neutralized, when the disturbing force acted simultaneously in the opposite direction. In support of this view it was adduced, that the oscillations of an engine were not coincident with its pulsations, as they would be in the theoretical case of an engine without flanges; but that they were very irregular, sometimes extending over a period of eight or ten pulsations.

In the deductions as to the extent to which the oscillation of the engine was occasioned by the varying operations of the steam in the cylinders, the whole weight of the engine had been taken into account; whereas, it was contended, that only that part of the mass which was upon the springs ought to be considered. The motion communicated to this portion of the bulk of the engine would be in excess of the estimated results; but even then, the amount of oscillation which was known to exist would not be arrived at. With a perfect road, and an engine accurately adjusted, it was not possible to put that engine exactly straight upon the rails. Nor could any slight defects, such as the wheels being out of truth the one-hundredth part of an inch, be detected. Neither were there any means of investigating the extent to which these defects prevailed, because they might be acting either together, or in opposition to each other, and thus might aid, or retard the oscillation, or the tendency to oscillation, which the backward and forward pressure of the steam in the cylinders must occasion to the boiler and other parts connected with it.

In reply upon the discussion it was remarked, that if all oscillation was to be referred to defects in the permanent way, it might be asked, why travelling on a railway worked on the atmospheric principle was so decidedly superior, in ease and steadiness of motion, to travelling on a line worked by locomotives. It was believed it had been established in the Paper, that even if the permanent way were mathematically perfect, locomotive engines of the ordinary construction would create lateral and oscillatory movements of a grave character at high speeds, and results similar to those produced by numerous small depressions in the level of the rails. It had been maintained, that any oscillation in the engine, produced by the internal disturbing forces, would be the same at all velocities. This involved two erroneous assumptions. It had been taken for granted, that the time allowed for the oscillation varied inversely with the velocity of the engine, and that the disturbing force varied directly as the velocity. Now it had been shown, in the diagrams, that at 26 miles per hour there was a tendency in the engine to make two oscillations in each revolution of the driving wheel, whilst at 52 miles an hour there was a tendency to one oscillation only, in each revolution; so that the time allowed for an oscillation was the same, whether the train was moving at 26 or at 52 miles per hour. The pressures tending to produce oscillation were opposed by the friction of the wheel on the rail. The difference of these two pressures was the moving force producing tranverse motion; and whether this friction was assumed to be the one-fourth or only the one-tenth of the insistent load on the wheel, the moving force increased more rapidly than the velocity. Applying the same dynamical law which had been employed by several speakers, for calculating the measure of the effect of the tendencies to lateral movement of the front end of an engine while running, it was shown that, even so well-proportioned an engine as the "Great Britain," at 52 miles per hour, with a greasy state of the rails, would twice in every revolution of the driving wheel move laterally ¼ of an inch, and would strike the rail with the wheel flanges. A blow, once originated, between the flange and the rail would, from their elasticity, entail a series of blows at regular intervals of time; and should any of the series coincide in time and direction with the constantly recurring impulses to transverse movement originated by the engine, a heavier blow between the flange and the rail would follow; and this would be repeated, so that it was conceivable, that the pressures shown on the diagrams, occurring simultaneously with the rebound of the wheel from the rail, might ultimately induce a lateral pressure great enough even to drive the flange of the leading wheel up the rail, and so to cause the engine to leave the rails.

LEA'S IMPROVED CASEMENT FASTENER.

The great difficulty of keeping sashes, known as French casements, open to any desired extent, for the purpose of ventilation, has been severely felt. The present invention, which we illustrate in the accompanying engravings, and recently patented by Mr. W. Lea, of Wolverhampton, entirely overcomes the difficulty.

The invention consists in securing to the back of one flap of the hinge, by means of a pin, one end of a quadrant carried through an aperture in the flap itself; the other end of the quadrant passes through another aperture in the other flap of the hinge. At the back of the second flap, free to move on a pin, a rod or lever is fitted, which projects beyond the flap, and which is armed with a tongue or catch. Notches or holes are made in the quadrant, and on bringing down the lever so as to engage the catch into one or other of the notches or holes, the casement is retained open to the extent allowed by the particular notch or hole engaged until the catch is released.

Fig. 1 is a perspective view of a hinge constructed according to this invention and applicable for a casement opening inwards, and fig. 2 is a back view of one of the flaps showing the rod or lever which retains the quadrant in the required position; *a*, a^1, are the two flaps of the hinge, *b* is the quadrant secured by a pin to the back of the flap *a*, and passing through the aperture *c* in the flap, the other end of the quadrant passes through the aperture c_1 in the other flap a_1. At the back of the flap a^1 is fitted a rod or lever *d* free to move on the pin *e*; this lever *d* projects beyond the flap and is armed with a tongue or catch *f*. On bringing down the lever, the tongue or catch *f* engages into one or other of the notches *g* in the quadrant, and the casement is thus retained open to the extent allowed by the particular notch engaged.

Fig. 3 is a front view, and fig. 4 a top view of a hinge applicable to casements opening outwards, and fitted with a screw for engaging into holes in the quadrant *a*, a^1, are the two flaps of the hinge, and *b* the quadrant as before; *c* is a screw passing through a tapped lump *d*, and taking into holes *e*, *e*, in the quadrant. According to the hole into which the screw *c* takes, the casement is retained open to a greater or lesser extent.

LEA'S IMPROVED CASEMENT FASTENER.

FIG.1.

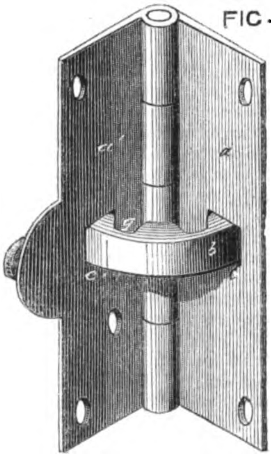


FIG.2.

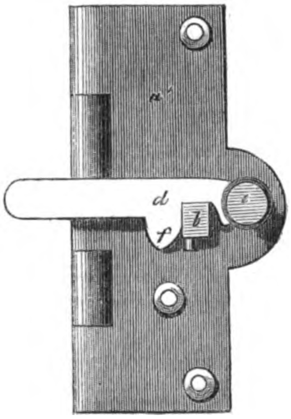


FIG.3.

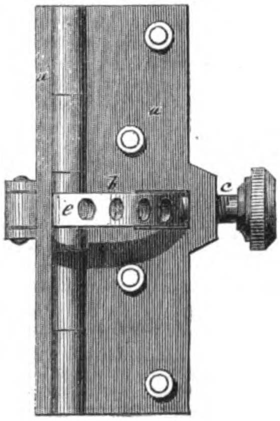
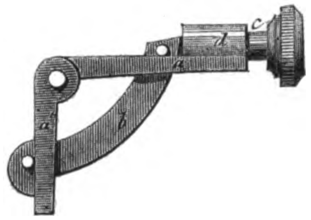
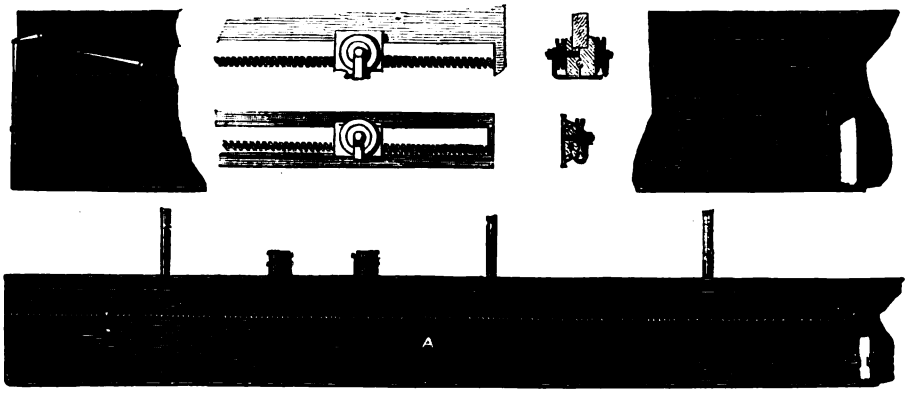


FIG.4.



APPARATUS FOR PREVENTING THE FOULING OF IRON SHIPS.



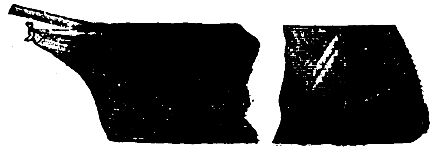
APPARATUS FOR PREVENTING THE FOULING OF IRON SHIPS.

Dr. James Gray read a Paper on this subject before a recent meeting of the Scottish Shipbuilders' Association.

After some introductory observations, Dr. Gray said: The fouling of ships' bottoms greatly retards their speed, and the attention of scientific men has been long directed to this subject. As yet, however, no plan has been suggested which fully answers the purpose designed. Fouling is chiefly caused by the adherence of sea-weed, mud, and slime, and the attachment of shell-fish; but it is the *living load* that is so difficult to remove. The young of these animals have the power of locomotion, and when they first adhere to an object they are soft and gelatinous; they harden as they mature, and become permanently attached. The species most destructive to wooden ships are the Limnoria Terebrans and Teredo Navalis; those that adhere to iron vessels are the Asteroida, Mollusca, and Cirrhopœda. In passing we may glance at the means which have been tried, although it is evident the wrong weapons have been employed against the enemy.

In early times, when vessels were small, preparations of sulphur, mixed with suet, rosin, or pitch, were used to prevent the ravages of Limnoria Terebrans and Teredo Navalis in wooden ships; and, later, copper plates were introduced on the sides of ships. But it was found that, although they protected the vessel from the ship-worm, Barnacles and various Mollusca adhered to the copper, and retarded the progress of the vessel. Zinc nails were then inserted in the plates, and a galvanic battery was formed on the ship's side; oxidation of the copper took place, and, so long as the oxide was bare, it acted as a poison on the ova of the Mollusca. When, however, the oxide got covered with sea-grass, slime, or mud, the animals adhered to this coating, and the vessel was again clogged. The same process could not so well be tried on iron vessels, as the galvanic current would injure both iron and copper, and it was recommended to try Muntz's metal, with a non-conducting agent between the iron and copper. This mode, although expensive and attended with difficulties, was adopted, but with very little effect; indeed, it would seem as if the Mollusca community regarded with supreme contempt the gigantic measures taken to dislodge them, and holding their property rights by virtue of *possession*, their security remained undisturbed. These creatures, moreover, seem quite as strong in home attachment as ourselves, and apparently have as little inclination to *flit*, when comfortably settled down, as have human families. The latest, and most expensive, recommendation is the electro-typing process. Mr. Wallen claims as the merit of his invention, that he can precipitate a pure metal, or combination of metals upon iron of any uneven form with a perfectly even and bright surface, but as barnacles adhere to the smoothest surface, even to glass, the object sought will not be obtained, and there can be no doubt that the sheathing and coating of vessels with costly metals is merely to *garnish* the habitation of the enemy—a useless extravagance; for if the copper is not oxidized, the ova of the shell-fish will adhere; if it become oxidized, the thin layer will soon corrode, and the expensive process of electro-typing will require to be repeated.

A great variety of paints and compositions are in use for anti-fouling purposes, but the objections to these are, that they can be plastered over with seaweed, mud, and slime, and the poison which enters the paints is prevented from acting on the ova of the Mollusca. The compositions which are effective in destroying the animals have an injurious effect on the iron. Arsenious acid, for instance, contains three atoms of oxygen, part of which being given to the iron, ultimately destroys the plates. The same effect is produced by common red lead paints, which also contain three atoms of oxygen, the red lead parts with its oxygen, and the iron is oxidized. I would recommend that an anti-oxidizing paint be prepared for ships' bottoms, and this part of the work of a vessel should be more carefully gone over. Frequently before the paint is sufficiently dry the ship is launched. Hurried coatings of paint may effect a saving at the time, but it is in the end being penny wise and pound foolish; for if the paint has not time to harden before the ship is sent into the water, and a thick coating laid on, the water passes through the pores of the paint, and the iron becomes oxidized. An outer coating may seem perfect, and yet the plates be so oxidized that a foot can be thrust through the ship's side after a few voyeges. An anti-oxidizing paint (such as I showed in the late International Exhibition), carefully applied, and allowed to harden between each coating, would amply repay in the end the loss of time in the work.



My attention being directed to the fouling of ships' bottoms, I was led to experiment with different coatings on iron plates. These were deposited in Largs Bay for some months; but I found, although successful in preventing the ova of shell-fish from adhering, the coating required to be renewed, and the surface of the plates cleaned. On careful consideration I became convinced that it was only by mechanical means the living impediments could be removed, and having decided this in my own mind, I invented the "Apparatus" now before your notice.

This invention has for its object the cleaning of ships' bottoms in an effectual manner, either while the vessel is sailing or in port; and it aims at *preventing* fouling, or accumulation of shell-fish or sea-weed, by providing means for continually removing adhering matter when beginning to attach itself, and when it is most easily removed. It is applicable both to wooden and iron vessels.

The apparatus is simple, and can be worked by manual or steam power in the following manner:—A brush, or scraper, is made to pass from stem to stern, or from keel to water's edge, daily, or as often as required; it is worked by means of guides at both stem and stern as shewn in which a block is raised and lowered by a screw; a pulley is attached to the block for the brush rope passing under; at the stern is placed a double-barrelled and double-brake winch; the brush rope is fastened to one of the barrels, and passes down the stern along one side of the ship's bottom to the stem, as shewn in the cuts, and along the other side of the ship's bottom and up the stern, where it is attached to the second barrel of the winch; while winding with one barrel, the rope is kept taut by the brake on the other barrel. The guides, if bolted to a screw steamer, may be passed down the stern as far as the swell for the screw shaft; in an armour-plated vessel, the guides can be placed in the plates. When it is not convenient to have a screw, the block for the brush rope can be raised or depressed by a rope or chain fixed to the top and bottom of each block. The chain or rope attached to the bottom of the moveable blocks passes in a groove along the keel, protected by a tube or lid; the rope attached to the top is wound round a small winch brake at both stem and stern.

Another mode of application is by an endless chain, or rope, passing under a pulley attached to the bottom of the vessel, and round a small winch barrel on the deck; the block for the brush rope, with pulley attached, is fastened to this chain, and raised or lowered by winding round the small winch. In this way the brush ropes are wound round winches at bow and stern, each side having a separate rope for itself. The brush may be made of whalebone, galvanized wire, or vulcanised india rubber. If required, a knife or scraper can be fastened to the brush to secure the removal of every impediments. In long vessels two brushes can be used, in which case they will only have to travel half-way. For ships of war I would recommend the screw; merchant vessels may be worked by the endless rope; for yachts, and smaller craft the chain along the keel.

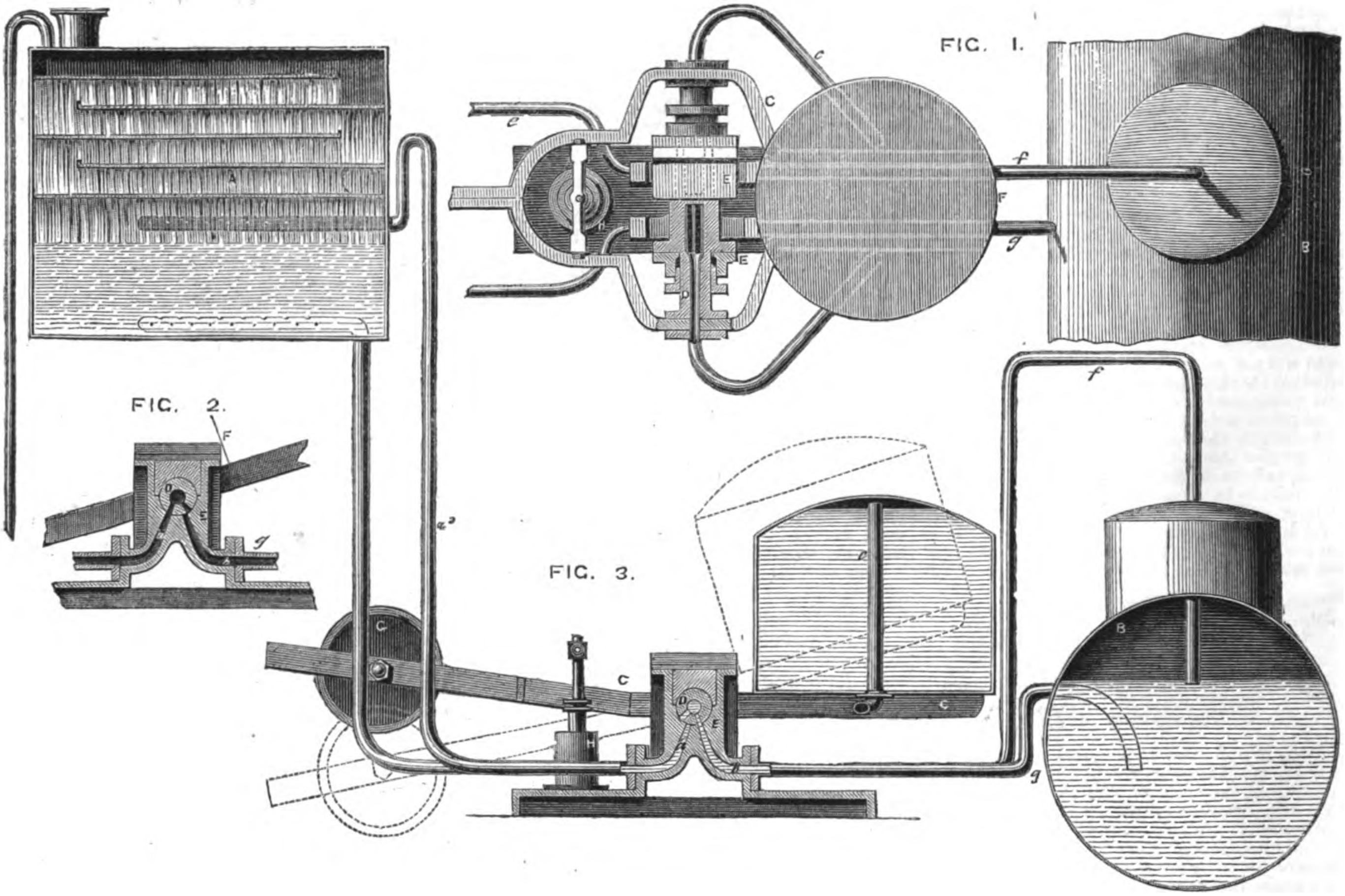
It may be objected that frequent brushing will wear the paint and damage the ship's side; but this will not be the case if vessels are properly coated with anti-oxidizing paint, as suggested. This invention would save the expense of dry-docking ships, and prevent time being lost in running them into the mouths of rivers in warm climates for the purpose of cleaning; and an important advantage would be secured in increased rate of speed—valuable cargoes could be got into the market at top prices, and to ships of war the difference of a clean bottom would materially assist a successful enterprize. Speedy voyages would curtail expenses in seamen's wages, food, fuel, insurance, and otherwise effect a vast saving.

In closing, I would impress the fact on your minds, that it is only when the living impedementa are in an ova state that they can be removed, and when the animal is soft and gelatinous, in the infancy of development, and this can only be effected successfully by a mechanical appliance.

FOGS AND FOG SIGNALS.

On the 13th ult. a lecture on this subject was given before the Royal Institution by Dr. Gladstone:—A fog, the lecturer said, was a cloud on the surface of the earth, and, quoting Dr. Tyndall's definition of a cloud as the visible capital of a pillar of invisible vapour, added that a fog was the capital without the pillar. The constitution of a fog was the same as that of an ordinary cloud: it was composed of water in the form of minute globules; there was no ground for believing that the water existed in the form of vesicles. A simple fog had the same appearance as a cloud, and the peculiar colour of a London fog was due to smoke. The lecturer then dwelt on the importance of fog signals to mariners, and showed the obstruction fogs offered to the passage of light, explaining that a simple mist offered great obstruction. He remarked that the character of the light exhibited on lighthouses was a matter of great importance, and showed that a fog entirely cut off the blue end of the spectrum, relating that the electric light displayed on the Monument on the evening of Tuesday, the 10th, was seen through the fog at Hampstead as a red light. Red light had been found to penetrate farthest, and Dr. Gladstone showed the effects of the coloured glasses used in the French and English lighthouses, the French being composed of red and orange, and the English of red only, the latter being visible at the greatest distance. The lecturer then said that for practical purposes it was necessary to distinguish between a mist and a fog, but this was not an easy matter. The same thing had a very different appearance to different observers. Landsmen in general had very loose notions about a fog, but a sailor's ideas on the subject were more definite. The lecturer showed by a reference to the reports of several lighthouse keepers on one corner of Scotland that what was evidently the same fog was variously reported as fog or as simple mist. In order to get uniformity in these reports, Mr. Cunningham had proposed to erect a pole, painted vermilion, as a test object, and suggested that everything which rendered this invisible at a hundred yards should be considered a fog. This test had been accepted by Mr. Glaisher, and may be generally received. The returns from various lighthouses round our coasts showed that fogs were sometimes of very small, and at others of very large extent. In London they were generally local; but a comparison of the returns of lighthouse keepers had shown the lecturer that some extended over a large area. There was one on April 14, 1861, which enveloped nearly the whole coast of Ireland, and was also seen in Wales, Scotland, and on one point of Cornwall. On April 1 of the same year it was foggy over nearly all Europe. Fogs had been found to be more common at one time of the year than another. November was considered the foggiest month in London; but in the South they prevailed most in January and June. The east of Scotland was in general free from fog in January, but had many in September, May, and June. In Ireland there was seldom any fog in February. Some years, too, were remarkable for fogs. England, the lecturer said, did not deserve its reputation for fogginess, statistics proving that fogs were not more frequent here than in other countries. The sea was much more uniformly covered with fog than the land; and it was found on our coasts that high headlands with a south-west aspect were peculiarly liable to fog, which was explained by the fact of a south-west wind coming loaded with moisture from the Atlantic.

The lecturer then entered upon the subject of fog signals, and showed that, light failing, it was necessary to have recourse to sound. Many means of producing sound had been used—bells alone, and bells with mirrors behind them (as at Boulogne) to collect and send forward the sound. Gongs had been used on lightships, guns were also employed, and steam-whistles, which last were highly spoken of. Sea-birds had been encouraged on the Skerries, and were believed to have been of some use, until some rats escaped from a shipwrecked vessel and began to devour them. A cat was introduced to remedy this, but it was found, unfortunately, that she preferred birds to rats. The objection to the use of sound was that it did not indicate the direction of the danger, but still it had at times been useful to steerers, and Dr. Gladstone related one or two instances in which vessels had been safely steered, the steerer being guided by sound and the constant use of the lead. Another objection was that one sound was easily confounded with another sound. Bells were rung for many purposes, guns were used as signals of distress, steam-whistles were always going; but still it might be found possible to agree on some plan to regulate a system of sounds. One more objection was that a breeze interfered with the passage of sound. It was true that in a dense fog there was generally a calm; but then came the most serious objection of all—that fog affected the transmission of sound, not so much as of light, but still to an appreciable extent. The composition of a fog, too, had a great influence on sound. Perfectly damp air was a much better conductor than a dry atmosphere mixed with some fog. As the use of sound, however, could not be discarded, it was necessary to find out the quality of the sound which was able to travel farthest, and fall back on experiments to ascertain this. Many had already been made, and more were in progress. Horns, trumpets, whistles, and whistles combined with a rattle, guns on a level and guns on a height, had all been experimented on, as well as the influence of pitch, and the repetition of discordant rather than concordant sounds. The influence of the background had also been examined. When on this part of the subject, the lecturer exhibited a small model of Professor Holmes' trumpet, BRIERE'S PATENT APPARATUS FOR FEEDING STEAM BOILERS.



which was sounded, and which gave the audience a satisfactory idea of the power of the instrument. The transmission of sound through water was then considered, and, as this would be totally unaffected by waves or fog, Dr. Gladstone deemed this the most fruitful line of investigation.

BRIERE'S PATENT APPARATUS FOR FEEDING STEAM BOILERS.

A patent has been obtained in this country by M. Brière, of Brussels, for a continuous self-acting condenser and boiler-feeding apparatus, which the patentee describes as follows:—

Fig. 1 of the annexed engravings shows a partial plan view, and fig. 2 a longitudinal section of the feed water apparatus, the same being interposed between the boiler to be supplied and the tank forming the source of supply. A is the supply tank, and B the steam boiler; C is a rocking frame mounted upon and keyed to a rock-shaft D, which is made hollow through the greater portion of its length and furnished with lateral openings. This shaft, therefore, besides carrying the frame C, forms also a pair of rocking cylindrical valves. The valves are each furnished with two lateral passages and they are mounted in valve boxes E, E, which are formed with two diverging passages *a*, *b*. The passage *a* of the valve box E communicates with a water supply pipe leading from the water tank A, and the passage *b* communicates with a water supply pipe leading to the boiler B. A similar arrangement is adopted with respect to the valve box, one passage being connected to a steam pipe leading to the tank, and the other *b* to a steam pipe *f* leading to the boiler. The rock-shaft D is coupled at its extremities with pipes *c*, *c*, which lead into a closed or steam-tight chamber F (which I call a condenser), mounted on one end of the rocking frame C, and above the water level of the boiler B. The other end of this frame car- an adjustable weight G, which is intended to rbalance the weight of the condenser and its contents at a certain period of the action of the apparatus, and thereby rock the frame into the dotted position, for the purpose of shifting the valves and stopping or diverting the passage of the water and steam through the apparatus for the purpose to be presently more particularly explained. The pipes *c*, *c*, enter the chamber or condenser F at the bottom, and one pipe projects to near the upper end thereof, while the other stops short at or near the bottom. The object of these pipes *c*, *c*, is to supply the condenser alternately with water and steam. As, therefore, the water accumulates in the condenser, the weight G will be overbalanced; and as the water is discharged therefrom, the condenser will rise. When the water in the boiler falls below the proper water level, steam is supplied to the condenser from the boiler B by the steam pipe *f*, which dips down from the crown of the boiler to a point a little below the water line. The pipe being coupled, as already explained with the valve-box, conveys steam to the interior of the valve contained in that box (the valve being at the time in the position shown in section in fig. 2). As the pressure of the steam in the boiler and condenser is equalized (the valve being at this moment in the position shown at fig. 2), the water will flow down from the condenser by the pipe *c* to the valve, thence down the passage *b* to the pipe *g*, and by that pipe into the boiler. The condenser being lightened by the discharge of water therefrom, the counterweight G will come into action, and through the rocking frame C shift the valves to the position shown at fig. 3, thereby opening a passage for the escape of the uncondensed steam (if any) from the condenser, and by the valve opening a passage for the supply of water from the tank. Water descending by its pipe will enter the passage *a*, and passing through the valve in the valve-box will flow by the pipe *c* into the condenser. The chamber F being now filled, will fall and the valves will be shifted again to the position shown at fig. 2, thereby allowing a fresh supply of water to descend from the condenser or chamber F into the boiler, and at the same time opening a way for the steam to escape therefrom as before noticed. This escape steam, after having performed its office in the chamber F, may, at the next shift of the valves, be conducted from the chamber F by the pipe *e* into the water supply tank when the supply water is required to be heated, or it may be discharged into the atmosphere. To facilitate the heating of the feed water, the water may be discharged from its primary source on to trays in the tank and fall in thin streams from one to the other, as shown at fig. 2, the steam let into the tank passing up and mingling therewith. For the purpose of acting as a check to the vibration of the rocking frame C, it may be convenient to provide a brake apparatus as shown at H, consisting of a water cylinder and loose piston, the latter being connected by a cross-head to the framing. The play of the piston in this cylinder will offer a sufficient resistance to the movements of the rocking frame to prevent a too sudden or beating action.

CLEMENTS, LLEWELLIN, AND JAMES'S SELF-ACTING LUBRICATOR FOR STEAM ENGINES.

The annexed engravings illustrate an invention recently patented by Messrs. Clements, Llewellin, and James, of Bristol, for a self-acting lubricator for steam engines.

The invention relates to a novel apparatus which, when adapted to the steam supply pipe of an engine, will supply a regulated quantity of the lubricating material to the inside of the valve box and cylinder, and other working parts of the engine.

Fig. 1 is a front elevation, and fig. 2 a side elevation, of the apparatus complete and ready to be adapted to a steam supply pipe; fig. 3 is a top or plan view of the same, and fig. 4 a plan of the under side.

CLEMENTS, LLEWELLIN, AND JAMES'S SELF-ACTING LUBRICATOR FOR STEAM ENGINES.

FIG. 2.

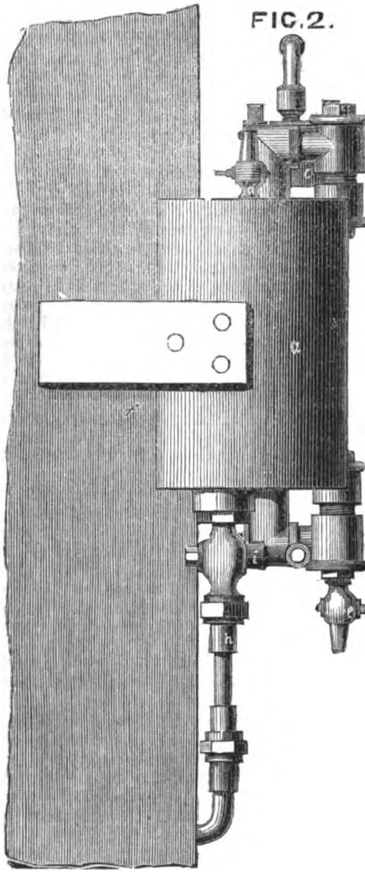


FIG. 1.

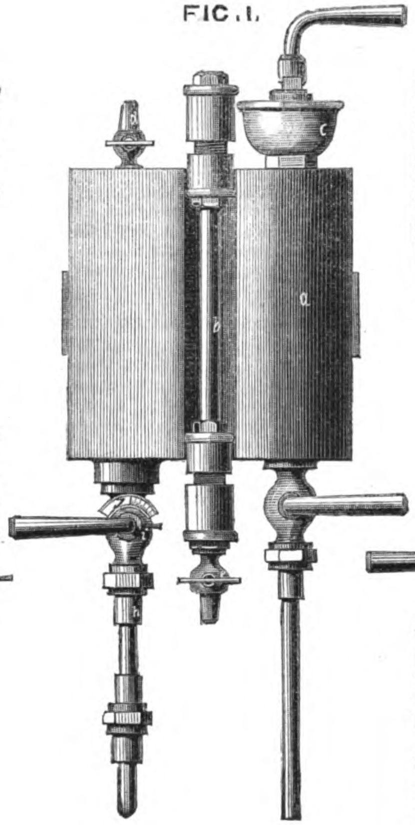


FIG. 3.

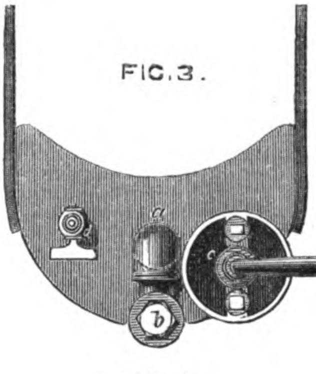
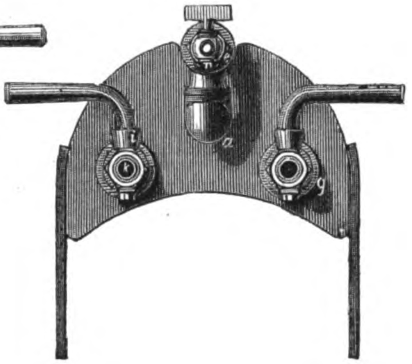


FIG. 4.



The apparatus consists of a steam-tight vessel *a*, for holding oil, tallow, or other lubricating material, and which is provided with a glass tube *b* for showing the height of the lubricating liquid in the vessel *a*. On the top of the vessel is placed in a funnel *c*, provided with a valve for charging the vessel *a*; and in order to facilitate this operation, an air cock *d* is fixed in the top of the vessel *a*, for the purpose of allowing the air contained therein to escape when the lubricating material is supplied thereto. A similar cock *e* is also placed at the bottom of the vessel, to admit of the condensed steam or foul tallow being discharged when required.

The apparatus is attached to the steam supply pipe *f*, by means of any suitable connection, provided with a cock or valve *g*, for regulating the admission of steam into the vessel *a*, through a pipe carried above the surface of the tallow or lubricating material, as shown by dots in fig. 1. There is also another pipe *h*, to conduct the oil, tallow, or other lubricating substance to the slide valve, the cylinder, piston, air pump, and other internal parts of the engine. The pipe *h* is provided with a cock *i*, and a divided sector index plate *j*. The handle of the cock *i* is provided with an index or pointer i^1, which when the cock is turned to admit the lubricating material from the vessel *a*, to pass into the tube *h*, will indicate the exact extent to which the cock is open; by this, after a little experience, the engine man or attendant will be enabled to regulate the supply of lubricating material with great accuracy.

It will be understood that when the regulated supply of the lubricating substance is allowed to pass the cock *i* into the tube *h*, it will be carried forward into the engine, by the current of steam that is admitted to and made to pass through the vessel *a*, and into the pipe *h*, with the lubricating material, which latter will therefore be distributed over the whole of the parts requiring lubrication.

By means of the above apparatus, it is said that not only can all the working parts be more thoroughly and efficiently lubricated than heretofore, but a saving of one half the tallow or lubricating material usually consumed will be effected.

The apparatus is simple in its arrangement, and is capable of distributing the lubricating substance over the whole of the internal surfaces of the engine from one source, the supply being regulated to the greatest nicety by means of the cock *i*, as above explained.

EXPERIMENTS AT SHOEBURYNESS.

On Friday last the members of the Ordnance Select Committee and the Ironplate Committee, with several officers of the Artillery and Engineers, made some novel gunnery experiments at Shoeburyness both with cannon and forms of projectiles. The first was made by the Ordnance Committee entirely, and consisted of trials to ascertain how far a method now rather in favour among French artillerists—by which a series of holes, about an inch in diameter, are bored through the substance of the cannon near its muzzle, in order, by permitting a quick escape of gas, to diminish its recoil—affects the service of the piece as to range and accuracy. The experiments were made with two brass nine-pounder ordinary smooth-bore field-pieces, which were loaded with the usual service charges and spherical shot. Five rounds were fired from each gun in succession, the recoil of both being carefully measured after each discharge. They were then shifted, so that each occupied the platform which had been used by the other, when again more rounds were fired. The minute official results of the experiment are not likely to be made out for some days, but the general merits of the performances of each gun could be seen at a glance, and were exactly what were anticipated before a shot was fired. The recoil of the ordinary guns was, in round numbers, just twice as great as that which had the holes bored round the muzzle, while the range and accuracy of the latter were scarcely more than half as good as that of the common piece. The lateral escape of gas and flame through the side holes of the French gun, if we may so call it, was very great indeed, so much so as to prove at once that, even if the gun otherwise possessed the most transcendent merits, it could never be used either on shipboard, in casemates, or even at embrasures. In the open air on Friday the trigger had to be pulled by a lanyard nearly 20 yards long. One half of the force of the explosion evidently escaped through the side holes before the force of the powder was expended on the shot, and virtually therefore the barrel of the gun is shortened by as much of its length as is thus perforated. As a general rule, the recoil of the gun is always in exact proportion to the force it exerts in propelling the shot, and anything which takes off from this recoil, by allowing the gas generated by the explosion to escape before it has done its work, just diminishes by so much the range, and, therefore, the accuracy of its fire. The results obtained with this curiously bored gun on Friday were enough apparently to satisfy the Ordnance Committee that it would be a waste of time to continue the experiments further.

Some experiments were then made with the Armstrong 110-pounder service-gun, loaded with steel shot, against a box target faced with 4½-inch plates, and lined inside with teak and an iron skin like the "Warrior." The only interest of this experiment was to test the penetrative power of the projectiles, one of which was prepared by the Ordnance Committee, weighing 65lb. and fired with a 16lb. charge of powder. The immense superiority of this projectile over the cast and wrought iron shot, which, as the standards or units of penetration, were fired at the target before, was at once apparent. Its indentation was nearly 50 per cent. deeper than either the wrought or cast iron missiles. The next shots tried were those of a peculiar kind of steel made by Messrs. Makin and Sons, of Sheffield. Friday was the third time that steel shots supplied by this firm have been tried at Shoeburyness, and always with the same result—that their metal, both for toughness and hardness, is superior to any other kind that has yet been experimented upon. A conical-headed shot of this kind, of which the cone was small and sharp, with a very full shoulder, weighing 65lb. and propelled by only 14lb. of powder, smashed its cone completely through the plate, damaging the backing and breaking a rib behind—the greatest result that has ever been obtained with so light a shot and so small a charge. It was evident that only the very full form of the shoulder beneath the cone (part of which was sheared off) prevented the whole going completely through the target. A second shot of the same kind, the same weight, and fired with the same charge, struck the upper plate of the target on an uninjured part, and about 12 in. from its edge. It completely smashed away a piece about 15 in. deep by 18 or 20 wide, splintering and ripping up the backing behind. One piece of the plate, of considerable weight, was carried far behind the target where it fell with the shot itself. An examination of the latter showed a part of the cone broken off, but in other respects it was little injured, though the injury to the target was very formidable, in spite of the hard, rather than tough, character of its metal. The trial seemed to show that, to pierce the plates, almost as much depends upon the metal of the projectile as upon either the gun or charge of powder which fires it. Certainly, the result seemed quite to upset the notion that a flat-headed shot is essentially necessary to punch armour plates, and, on the other hand, to strengthen the belief that the best form for this purpose may, after all, and with proper metal, be found to be the conical form adopted by Sir William Armstrong. There was only one opinion expressed as to the quality of the metal supplied by Messrs. Makin—it was, as we have said, the best that has yet been tried.

As it seems probable, from the remarks made in the House of Commons the other night, that some members intend to honour future experiments with their presence, we would, as a preliminary step, earnestly recommend them to take a liberal view of the Shoeburyness estimates, in order that some really stout splinter-proofs may be erected, from which they may see the trials with something like safety. Without some such additional safeguard, even all the care and precautions taken by Colonel Taylor cannot long avert an accident. On Friday the officers engaged and all the members of the committee had very narrow escapes from two large fragments of steel splinters which came through the splinter-proof and passed over the heads of those crowded in it, fortunately without touching any one. All the splinter-proofs are more or less rough, temporary erections, made of any strong materials that are nearest to hand. And, indeed, in all its appliances for shifting guns, &c., there is an evident want of proper means to the end, which is not what one expects to meet in a practice ground of such national importance as Shoeburyness has now become. This want of a proper plant doubles the labours of a most zealous staff of officers, who, without such additional duties, are already almost overworked.—*Times*.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Correspondents who wish their manuscripts to be returned are requested to state this.

We beg our correspondents to choose initials, rather than general signatures such as "Constant Subscriber," or "Reader," &c.

Received.—J. H.

To Makers of Ice-making Machines, and of Apparatus for testing the Lubricating Qualities of different Oils.—A correspondent inquires the names of makers of the above apparatus. Any communications sent shall be forwarded to him.

T. K. (Canterbury.)—We would suggest to you, as a preparation before beginning a course of experiments in the *perpetuum mobile* line, to try to lift yourself up in a basket. After achieving that feat, you can then begin to make your "eternally moving" wheel. Perhaps, before attempting the basket experiment, it might be best to read attentively a work on Mechanical Science?

L. S.—The sole manufacturers of Giffard's Injector are Messrs. Sharp, Stewart, and Co., of the Atlas Works, Manchester. The inventor, Monsieur Henri J. Giffard, may be addressed "Aux soins de M. Fland, constructeur, Rue Jean Goujon, Paris."

S. P. T. (Manchester.)—Write to the Admiralty, stating age, qualifications, and antecedents.

James B. (London.)—We are naturally sorry to reject the communication of a valued correspondent, but on reading your article, we find that it is scarcely suited for our paper.

W. A., Civil Engineer (Milford.)—Your plan seems suitable and original, but in the pressure of engineering matter we are obliged to confine ourselves to subjects that are more specially in our line.

T. P. T. (Eliot Vale, Blackheath.)—The reason that "*we do not hold ourselves responsible for the opinions of our correspondents*," is not to escape the law of libel, but rather that we look upon the columns we devote to the letters of our correspondents as an arena for the *free* discussion of scientific subjects. Any responsibility we might assume would, of course, interfere with this complete freedom.

J. C. (Ball's-pond).—We cannot insert your last communication: it requires more condensation and better caligraphy. We rather differ from you as to the non-patentability of so-called "frivolous" or small inventions. We could, if space allowed, adduce many arguments to support our views; but, in any case, where would you draw the line of demarcation?

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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THE SPHERE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—As among the Mechanics of the United Kingdom there is known to exist a lively interest not only in the practical results of geometry but in the clearness of the reasoning by which they are arrived at, the following from an old correspondent may not be unacceptable.

"On the Generation of the Straight Line and Plane, as deducible from Plato's Property of the Sphere." By Lieut.-General T. Perronet Thompson, F.R.S.

In the *Timæus* and two places in the *De Anima Mundi*, Plato calls the sphere "of all figures the most perfect," because it is "the only figure capable of both at rest and in motion fitting in the same place without either quitting it or taking up new ground; in consequence of all the points in its surface being equidistant from a point in the middle." Which is what is intended by the modern expression of "being without motion in fixed space."

This property appears applicable to the relief of some discrepancies in the outset of geometry, evidences of which exist in the five or six different descriptions of a straight line found among ancient and modern geometers.

That two spheres, equal or unequal, touch only in a point, is demonstrable with the help of the Platonic property. For, if they are supposed to touch in anything which has parts or magnitude, as for instance an area, then by turning each sphere severally about its centre, two portions of their surfaces which at one time coincided throughout, may be made at another time to coincide in some of the same identical parts, and in others be separate; which is impossible if the bodies have undergone no change of form. And the same sort of proof is applicable to a supposed contact in a line of any kind, even though self-rejoining and uniform. Also, the contact cannot be in insulated points more than one; for if the touching spheres were formed into one body, as would be done by the application of a cement to the interstices, this compound body could be turned about the two centres of the spheres, the centres remaining at rest; because the two centres can be applied to the same points in fixed space, under any number of different positions of the rest of the body. And because they are the centres of the spheres respectively, each sphere will be without motion in fixed space, and the whole compound body be so too. Whence, if on turning abouut the two centres one insulated point of contact remained at rest, any other supposed insulated point of contact must change place by moving round it; which is impossible if the whole compound body and every part of it is to be without motion in fixed space.

After this, let two spheres, equal or unequal, touch and be turned as one body about the two centres, whereupon the point of contact will remain at rest. And if one sphere be made larger and the other smaller, the centres occupying the same places as before, and the contact being maintained, the new point of contact will equally remain at rest; and the same for any number. Hence, if the alteration in the magnitudes is made to be continuous each way, the point of contact will describe a line from one centre to the other, every point in which on the line's being turned about its two extremities will be without change of place. *The line shown to be capable of this property* is called a Straight Line. And two such lines cannot inclose a space; for if one of them was turned about the points of junction without change of place, the other could not, but must be moved round it. And on similar principles may be shown that two straight lines cannot have a common segment, and that the straight line is the shortest.

An extension of the same methods will show, that if the surfaces of two equal spheres cut each other, their intersection is one line without breadth. Let then two equal spheres touch, and about the same centres describe two larger spheres equal to each other. Join the point of contact of the smaller spheres, and any point in the intersection of the surfaces of the larger, by a straight line of unlimited length. Make the whole turn about the two centres which remain at rest, and this straight line shall describe a surface having the property that the straight line between any two points in it, lies wholly in that surface.

For, in consequence of visible equalities and the Platonic property, the whole system may be turned about the two centres without change of place in the spherical surfaces or their intersection. And if the centres are interchanged (or one set of spheres put in the place of the other) and the system again turned about them, there will still be no change of place of any of the surfaces, nor in the revolving straight line when it passes through the same point in fixed space in the intersection of the spheres. Which is the same as to say the two surfaces described by the revolving straight line before and after the interchanging of the centres will be capable of mutual application and coincidence in all their parts with inversion, and be one surface. Follows from which, that any point in this surface is equidistant from each of the two centres, for the two distances can be applied to one another; and the point would consequently be in the intersection of the two equal spheres which should be described about the centres with that distance. In the intersection then of two of the larger equal spheres, join any two points, and the straight line or chord between them shall lie wholly in this surface. For, if the two extremities of the chord were made the centres of two spheres equal to the previously intersecting ones, the two original centres would be found in the intersection of these new spheres, by reason of the equality of the distance from their centres to their circumferences; and, consequently, if the whole system were turned about the two extremities of the chord which remain at rest, one of the original centres might be applied to the place previously occupied by the other. And because the chord and every point in it are during this operation without change of place, the straight line drawn from any point in the chord to one of the original centres, would be found applied to the straight line drawn from it to the other; therefore they are equal. Whence, such point in the chord would be in the surface described by the revolving straight line, and no where else; for if it were otherwise, there would be two different intersections of pairs of spheres, all equal and about the same centres; which cannot be, for the intersection will be one and the same. In like manner, every other point in the chord may be shown to be in the surface; therefore the chord lies wholly in the surface. And because through any two points in so much of the surface as is within the intersection of the spheres, a chord may be made to pass, the straight line joining any two such points lies wholly in the surface. But if one or each of the points is outside the intersection of the spheres, it may be included by enlarging the intersecting spheres, and so there may be proved as before. The surface shown to be capable of this property is called a Plane Surface.

It may not be necessary to begin by laying all this before the little boys, but grown geometricians may feel grateful to Plato for clearing the way to knowing there can exist things with the properties ascribed; the best way of doing which is to know how on a pinch they might be made.

I am yours, &c.,
T. Perronet Thompson.
Eliot Vale, Blackheath, March 27, 1863.

IRON WALLS AND THEIR ARMAMENT.

WOOD BACKING.

Sir,—It is a pleasure to encounter so rational and honest an opponent as your correspondent "Iron." He takes up the defence of wood, as a backing to armour plates, with apparently so much reason that he would almost make me question the soundness of my conviction, if it were not confirmed by the incidents of target experiments recurring from time to time. I am more convinced than ever, that wood backing is a blunder—that it is, in fact, the main cause of the destruction of armour plates under the fire of artillery.

The argument I have to hold with the writer, who signs "Iron," is of a different character from that raised by other opponents. I have not to go back to the first elements of iron ship building, to convert wooden bigots from the false to the true faith. "Iron" believes that for strength and rigidity of structure, for durability, for displacement with proportionately less weight, and above all for the construction of large ships, iron is incomparably superior to wood. When the Controller of the Navy and the Lords of the Admiralty recant their errors, as they have done before Parliament assembled, we may hope that the worship of wood, as a material for building ships, will soon not have a follower left.

"Wood as backing" is a question distinct from "wood as a material for ships;" and whatever my individual opinion may be, I admit it is open to controversy. Your correspondent advances the premisses fairly. He claims that a bed of wood under a plate performs two functions: 1st, it absorbs the blow by speading the force of the projectile over a large surface; 2nd, it protects the iron hull from the impact "of the bulge at the back of the plate which forms in the rear of the 'locus' of impact." These precisely are the two points to be considered. On the first, I answer that a hard and rigid bed, if it be strong enough to resist the crushing force, will more effectually absorb the blow and, under the same condition, will prevent buckling. Of this fact "Iron" is fully cognizant; for in maintaining that "rigid ribs at some distance apart" would increase the tendency to buckle, in which he is quite right, he virtually admits that rigid ribs at short distances apart will prevent buckling. That is my opinion; and in answer to the reproach that has often been cast upon me, that I oppose the plans of others and propose none of my own, I am *now prepared to avow my belief that narrow iron cells, less in width than the diameter of the projectile, will form an efficient backing to armour plates*. To prevent vibration, and afford a fair bearing to every part of the back of the plate, I propose that these cells be filled with wood with the grain end on, or with some other tough material, which some experiments at Shoeburyness lead me to believe will be found in millboard or "papier maché." Again, "Iron" is right in seeking to guard against the tendency of the bulge to fracture the skin or the frames which support it, if no backing be interposed between the iron hull and the armour plates. This opinion is incontrovertible, but its truth does not prove that wood is the proper material to be so interposed. On the contrary, I contend it is a bad material, because its want of density and hardness, as compared with iron, is so great, that it offers no resistance to the bulge, which, being unresisted, its formation, at the moment of impact, puts the particles of wood in motion and transmits through them the projectile force to the ship's frame. Now, if a material as hard as iron—if iron itself form the backing and bed to the plate—provided the support to that backing be not crushed in, there will be *no bulge at all;* and that is the result which, I believe, an iron cellular backing would produce. I shall not dilate on this point; it can only be determined by experiments.

But I say, "Stop the bulge and you stop the mischief." That this can be done, I have seen. In my earlier letters I referred to a trial of rigid backing at Shoeburyness. A 2½ in. plate on a backing of cast-iron blocks, being fired at by a 40-pounder, which easily penetrated that thickness on a wood backing, received only a slight indentation on the face, and had no bulge at the back. A 100-pounder Armstrong, which would have smashed the plate if backed with wood, made an indentation of only half an inch in depth, and again caused no bulge to be formed. To conclude, and repeating what I have written twenty times, wood, by yielding at the point of impact, causes the ends of a plate to buckle. This throws the strain upon the bolts and tears them away, which is the worst disaster of all; for, deprived of its fastenings, the plate falls bodily off. In the last experiments, Messrs. Brown and Co.'s 7½ in. plate was doubled up by two heavy shots striking it at the centre, which was crushed 3 or 4 in. into the wood, whilst the ends were separated from the wood about the same distance. Several bolts were visibly broken; others, no doubt, will be found cracked in two inside the wood, when the target is taken to pieces, as was the case with many bolts of the "Warrior" section, when it was dismantled, after the experiments upon it.

Another serious objection to wood backing, which I have often referred to, is now proved, by the inexorable logic of facts. It can be set on fire by incendiary shells. I think the advocates of wood-backing will acknowledge themselves in error, and for the sake of your readers, who, perhaps, have had too much of this discussion, as well as for the triumph of truth, I shall be glad if that be the case.

WOODEN SHIPS OF WAR.

Another of your correspondents, of a different order, signing "Observer," makes a personal attack on me, under the pretence of taxing me with being "personally opposed to Mr. Reed." There are some so thin-skinned, and so self-satisfied, that they can suffer no notice in disparagement of their acts, words, or demeanour without ascribing it to personal animus. Some carry this feeling so far, that they exercise it vicariously, on behalf of the objects of their admiration. Like the Moslem, who treats as a dog the infidel disbeliever in Mahomed, "Observer" stigmatizes me because I don't believe in wood. Let him search through my writings, he will find my quarrel is not with Mr. Reed, but with his "wooden bottoms." I have said more than once, and I believe, Mr. Reed is a talented, honourable man, who has made a position for himself by perseverance and industry, for which he deserves great credit. But from what has been publicly stated of his career, and which he has not denied, I conclude he is not a practical shipbuilder.

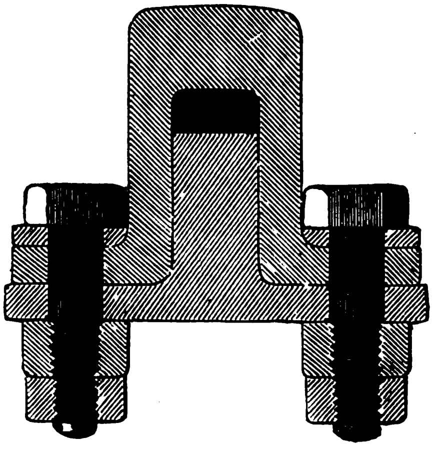
"Observer" is wrong in saying I doubt Mr. Reed's theoretical knowledge of naval architecture. He will not find in anything I have written a word to that effect. On the contrary, I believe I have often stated that his attainments in the theory of that science are considerable; and I think that, if placed in his proper sphere, as a designer, his services will be a great acquisition to the Controller's department. There is a rumour, which I hope may prove true; it is to the effect that Mr. Reed's appointment as Chief Constructor will be revoked, and that of Assistant Controller conferred upon him. Such an office is wanted, and Mr. Reed would fill it worthily. The Controller of the Navy, who, by an odd anomaly, has no knowledge, practical or theoretical, of the art and science of the department over which he presides, must be at a loss to direct the officers whom he controls. He cannot advise; he must be advised by them. He is in the position of a cavalry officer commanding a line-of-battle ship. To have at his side, as the medium of communication with the constructors and master shipwrights, and with the Board of Admiralty, a well-trained and clever assistant, who understands the theory of the profession, must be a great boon to him, and a real benefit to the public service.

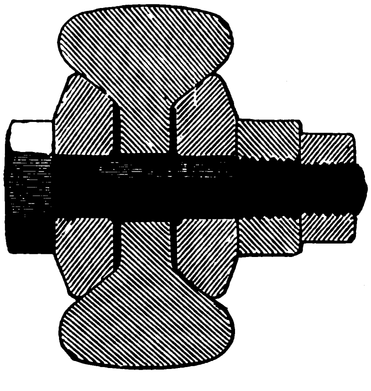
In thus stating in what I think Mr. Reed's real merit consists, I have not a word to retract in respect of his "scheme," or system, if "Observer" likes the latter word better. He inconsiderately exposed himself to attack by stating that his "Enterprise" would be as completely protected as the "Warrior." Knowing that not to be the case, I thought it a duty to disabuse the public by explaining the difference. It is idle to say that an iron-clad is not to be valued by the strength of her armour. If you want cruizers of great speed and with a heavy armament, which can harass the commerce of the enemy, and save themselves by flight from the attack of iron-clads, dispense with armour altogether, and you have an "Alabama" to sweep the seas and carry the "flag of Old England to the Antipodes." If you want light cavalry, don't mount small men on heavy chargers, and overwhelm them with cuirasses. "Observer" must not suppose that Mr. Reed is the only designer of fast ships under 1,000 tons. The sea-going properties of the vessels he has designed have yet to be proved, and sanguine as his friend "Observer" may be, many shipbuilders are doubtful of their success. I am glad to see there is a wholesome dread of an "Enterprise" target trial. At the meeting of naval architects, Mr. Reed deprecated such a trial, because he said it was well known the resisting force of an "Enterprise" broadside was not equal to a "Warrior's." Then why did he ever lead the public to infer that it was? This shows I hit the right nail on the head in mooting the proposition to construct a target. Admiral Halsted I am glad to find endorses my recommendation. I am also in good company in suspecting the Admiralty of proclivities for wood detrimental to the public service. Mr. Cobden, Mr. Laird, and Mr. Lindsay go quite as far as I ever ventured in condemnation and suspicion of their intentions and motives. The debate in Parliament, on the question of the best material for ships of war, will not, I hope, be set down as "fierce partizanship and one-sided reasoning." For my part, I am so satisfied with it as conclusive evidence that I have not misled your readers, and so will the country be, that whoever may be my assailant, I will not encumber your pages with further arguments in support of "wood *versus* iron." The "scientific problem," as "Observer" terms it, is now solved as clearly and unmistakeably as the planetary system.

CIVILIAN.

FALKINER'S METHOD OF FASTENING RAILS AND FISH-PLATES.

The annexed engravings show an improved method of securing the fish-plates of railways, recently patented by Mr. T. H. Falkiner, of Dublin. The improvement, consists in forming upon the ends of the bolts employed two screwed portions or lengths, as clearly indicated, the one being of larger diameter than the other, and the threads on each portion being in reverse directions, the one portion being a right and the other a left hand thread. On each of these portions a nut corresponding to it is screwed, that on the inner screwed portion serving as the ordinary or tightening nut, whilst that on the outer portion (which is of lesser diameter) being screwed in the reverse direction serves the combined purposes of jamming the inner nut and of counteracting the tendency of the bolts to turn loose.





BARRETT'S PATENT FOR CASTING RAILWAY CHAIRS.

When making a mould for the casting of a chair and sleeper known as "Greaves," and which we illustrate in fig. 1 of the annexed engravings, through which the bars are passed, cores are used to produce the requisite holes. The invention which is shown at fig. 2 has been patented by Mr. W. Barrett, of Norton Furnaces, near Stockton-on-Tees. It consists in making the core in two parts, one part of iron and the other of sand, as represented. The portion which is of iron is (when covered with loam) moulded in the upper box on the convex surface, which produces the hollow of the sleeper; the portion which is of sand is produced in the lower box in the same manner as the other parts of the mould. Thus it will be seen that the core is formed complete in the upper and lower boxes, and has not, as heretofore, to be laid in as a separate piece between the two after the pattern has been drawn, and the mould is otherwise complete.

By this method the holes are cast perfectly clean and true, and require no fitting or filling, as the tie-bar will pass through the holes readily,

FIG. I.

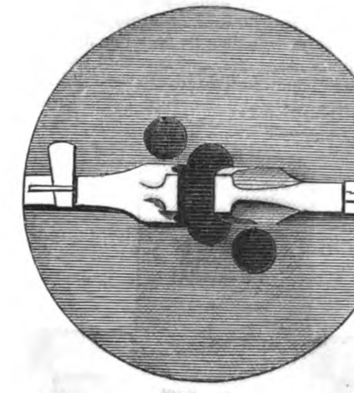
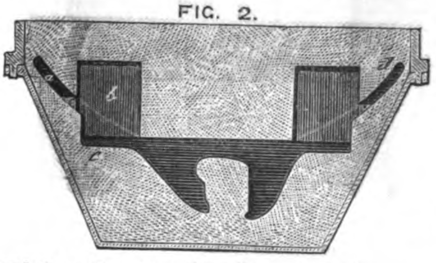


FIG. 2.



and the ends where the gibs and cotters come are also as true as possible. Time and labour also is saved in the moulding.

Meetings for the Week.

Mon.—*Royal Inst.*—General Monthly Meeting, at 3 p.m.
Soc. of Eng.—Continued Discussion on Mr. Colburn's Paper "On the Relation between the Safe Load and the ultimate Strength of Iron," at 7 p.m.
Medical.—Clinical Discussion, at 8.30 p.m.
Geologists' Assoc.—"Observations on Ammonites, and on the group of Molluscous Animals to which Naturalists refer those curious and beautiful extinct Shells," by E. Charlesworth, F.G.S., at 7 p.m.

Tues.—*Inst. Civil Engineers.*—Discussion "On Structures in the Sea, and Account of the Works constructed at the St. Germain's Sluice, Middle Level Drainage," by Mr. Hawkshaw, Pres. Inst. C.E., at 8 p.m.

Wed.—*Soc. of Arts.*—"On the Sewing Machine; its History and Progress," by E. P. Alexander, Esq., at 8 p.m.

Thurs.—*Antiquaries*, at 8.30 p.m.

Fri.—*London Inst.*—"On Economic Botany," by R. Bentley, Esq., at 7 p.m.
Architectural Assoc.—Class of Design—"Market buildings for a small town."

Gossip.

The Iron-plate Committee, consisting of Col. Henderson, R.A., Dr. Perry, Mr. Pole, and Capt. Harrison, R.A., assembled on Wednesday, in Woolwich Dockyard, for the purpose of inspecting the process for bending and preparing the coating of the "Caledonia." The committee arrived at half-past one, and having been attended by Mr. Turner and Mr. Thornton, master and asistant-master shipwright, and other officers of the department, they inspected the hydraulic presses and machinery, and examined with careful attention the method by which the heavy slabs of iron are reduced and curved with the most minute accuracy to the form necessary to fit the spot allotted on the ship's sides. The work is progressing speedily and with much success, 120 plates having been affixed to the "Caledonia" without a single mishap occurring, and in a manner which called forth the admiration of the committee. For some weeks past the "Caledonia" has been inspected by many eminent shipbuilders, who have expressed their opinion that the utmost ingenuity and intelligence are observable in the entire construction. Eighty additional hands have been added to the number employed, in order to hasten pletion of the work.

On Monday evening, a meeting of the members of the Inventors' Institute was held at the Polytechnic, Regent-street. Sir John S. Lillie occupied the chair, and the subject for consideration was "Inventions for obtaining aerated fresh water from sea water," which was introduced by Dr. Normandy. The doctor in his prefatory remarks explained the chief objects of the Inventors' Institute. It assisted in bringing before the public inventions worthy of being known. He then explained the old means which had been adopted to obtain fresh water from sea water. The result was, an imperfectly aerated water which was vapid and indigestible. He next went on to show the system he had introduced for the purpose of getting aerated water from sea water. The water so obtained he described as being pure, sweet, wholesome, and immediately fit for drinking. The lecture was illustrated by numerous experiments, and it met with a favourable reception.

A very curious chemical discovery has been made by Dissenbacher, a young German chemist. By the addition of a small quantity of chlorine or iodine, pure sulphur is rendered perfectly soft; and the Paris Academy, to whom the experiment was exhibited by H. Deville, were astonished to see a thin leaf of sulphur treated as flexible as if made of wax.

The costs incurred by the Admiralty in defending the action brought against them by Mr. Clare, for infringement of patent, amounted to £2,143, exclusive of the expense of a dozen witnesses who have not sent in their claims.

Several trials have taken place during the past week at the Royal Clarence Victualling-yard, Gosport, with Mr. Grant's patent oven, ordered by the Lords of the Admiralty to be fitted on board the "Hannibal" screw line-of-battle ship, depôt ship for the Royal Navy, at Portsmouth. The oven, which is made of iron exclusively, is capable of baking at one time about 500 lb. of meat or 300 lb. of soft bread. The trials carried out with both bread and meat have been most satisfactory. All parts of the oven have been found to possess a uniform temperature. When the meat has been served up in dishes from the oven it has been found cooked in a manner superior even to meat roasted carefully in front of a fire, the juices of the meat being more perfectly retained, and the waste in weight being very much less than with meat roasted.

The 5½-inch French armour-plate which was tested at Portsmouth on the 20th of March last, in company with a 4½-inch French plate and some English plates, and which stood the trial in an apparently successful manner, on the 27th and 30th of March, has been unbolted from the side of the "Powerful" target-ship, where it was tested, and removed to the erecting-shop of the steam factory in the dockyard. There a portion of the plate is being cut off by machinery by order of the Admiralty, for the inspection by the members of the Special Committee, now sitting on iron armour. Now that both sides of the plate can be seen, the damage inflicted is found to be much more serious than had been supposed. The peculiarly soft, spreading appearance which the metal of this plate had when struck by the shot on its obverse side, did not raise any apprehensions of serious injury to its reverse, beyond the ordinary and inevitable bulging of the metal. An inspection of the plate now, however, reveals the full extent of the damage the plate has received, and the rupture and separation of the metal is much greater than has been the case with some of the best English plates which have been tested at Portsmouth, the latter being, it is true, selected from some hundreds of trials, but, then, as has been before observed, the history of these French plates is not yet known. The 5½-inch plate had five shots planted in a space of 17 in. by 12. On now examining the reverse, or back of the plate, there is found behind these five shot-marks an irregular oval figure, 18 in. wide and 25 in. in length, where the metal has entirely broken away from the body of the plate to an average depth of 2 in., large cross fissures at the same time extending across the plates, bulging right through to where the shots struck, the apparent damage to the plate being, no doubt, considerably lessened by the spread of the metal before referred to. At the fracture of the metal upon the plate's reverse there is a peculiarly bright, soft, or lead-like appearance; but the layers of metal (the plate is a rolled one) are very much opened. On the upper edge the plate was struck by a single shot, the whole circumference of the blow being on the plate's surface and clear of the edge, but on a bolthole. Here the back of the plate, in the immediate vicinity of the blow, is entirely broken up and rendered useless for all defensive purposes. The body of the plate on the edge has opened up, the welding being, as stated in the report of the trial, very imperfect, and a semi-circular fracture extends from the edge 9½ in. in depth, the chord of the arc being nearly 2 ft. In cutting the piece out of this plate for the Special Committee the iron was found to be unusually hard, taking off the edge of the cutting tool in a manner that surprised the workmen engaged upon the work. It must be borne in mind that this 5½ inch plate was imperfectly welded in its manufacture, and that the 4½ inch apparently stood the best, comparatively, in the trial.

The Patent Ventilating Granary Company (Limited) have obtained their stipulated capital. One of the main objects of the directors is to induce the corn trade to build granaries in the United Kingdom on the new system, either directly, through the intervention of the company, or through licenses to be granted by it. The model granary is now in full work, and contains 1,200 quarters of wheat.

I (says Capt. J. Harvey in a letter), contend, as I have for many years past, that supremacy upon the ocean will mainly depend upon the speed of vessels —not upon their magnitude, structure, or heavy armament of cannon. It would, I believe, be something like certain destruction to any monster war vessel to pursue such a vessel as the Confederate rover if she were armed with submarine explosive shells in addition to her cannon, presuming that such shells are cf some simple form, of easy application, properly charged, and the management of them thoroughly understood. With regard to the speed of vessels adapted to the service of shells, they would, I think, have, in the attainment of that essential, a great advantage over vessels of ordinary form. The upper or weather deck of a shell vessel would be perfectly flush, with no bulwark above it; only stanchions and nettings to prevent those on deck from falling overboard, with weather cloths when needed; there should be nothing to hold wind that might be detrimental to speed. Shell vessels might in addition to their principal arm, have one or two guns to bring-to a merchadise or unarmed vessel. The gun, or guns, when used for such or any other purpose, would be hoisted up from the main deck on to the upper or weather deck, and fired over all. Vessels so completely covered-in would be enabled to encounter, without risk of foundering, any amount of rough weather. Sails, under such conditions need not be used, neither would steam be required, for the vessel's bow may be kept as near to the wind as may be desired by the use of a float anchor, and, so bowing the sea, would avoid the dangers incidental to lying-to under canvas. Shell vessels for home service should, I think, be wholly constructed of iron; while for foreign service I should, in the present difficulty of preventing corrosion and fouling of iron vessels for long periods, very much prefer wood and copper in the construction of shell vessels intended for foreign service or long cruises. Vessels on such service would be accompanied by "a waggon train" of vessels of burden to carry supplies.

A Destructive Shell.—During an engagement between the steamer "Mercedita" and the ram "Palmetto State," off the harbour of Charleston, a shell of 100 lbs. weight passed through the steamer, cutting one man in two, and by going through the steam chimney three men were scalded to death, three others badly scalded, and a number slightly. It passed out the port side, destroying six planks and two timbers, making a clear hole 3 ft. by 2½ft. and shattering the planks 8 or 9 ft. further. The shell exploded as it passed out. It is the opinion of the steamer's officers that, had there been a swell of the sea at the time, she must have gone to the bottom like a stone.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2428.
Boilers and Furnaces, 2429, 2430, 2468, 2477.

Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2444, 2449, 2475.
Ships and Boats, including their fittings, 2454, 2476.
Cultivation of the Soil, including agricultural implements and machines—*none.*
Food and Beverages, including apparatus for preparing food for men and animals, 2434, 2460.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2433, 2437, 2448, 2451, 2461, 2463, 2471, 2472, 2474.
Buildings and Building Materials, 2447, 2450.
Lighting, Heating, and Ventilating, 2436, 2453, 2457.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2438, 2439, 2440, 2443, 2455, 2458, 2478.
Metals, including apparatus for their manufacture, 2470.
Chemistry and Photography, 2459, 2462.
Electrical Apparatus, 2431, 2432, 2442.
Warfare, 2435, 2445, 2465, 2466, 2473.
Letter-Press Printing—*none.*
Miscellaneous, 2427, 2441, 2446, 2452, 2456, 2464, 2467, 2469.

2427. H. R. Trigg. *An improved fire escape.* Dated September 2, 1862.

This invention consists principally of a rope, chain, or otherwise-jointed ladder, the round being made of some hard material to keep the sides extended; under this ladder and attached thereto is a prepared canvas trough; they are conjointly made to revolve on an iron axle fixed in a light and ornamental casing, fixed over the window head inside the room; it is so arranged that it will upon turning a button unwind itself; the axle is provided with a break to prevent the ladder descending too quickly. When this ladder is down, a person can ascend at the same time as another party is descending. *Patent abandoned.*

2428. R. Glanville. *Improvements in marine and other engines.* Dated September 2, 1862.

This invention relates to the making use of the heat that radiates through the high pressure steam cylinder as a means of preserving the temperature of the steam in the expansive steam cylinder, and also in economizing space. To accomplish this, the patentee places a series of cylinders within each other, and connects them by their flanches and covers (or cover and bottom, the term being synonymous), and causes the pistons to move simultaneously. He connects the piston rods to a cross head connecting-rod, which operates on one crank. The cylinders are charged with steam by the aid of valves so arranged that each piston shall receive the impulse of the steam alternately. The steam first operates on the piston of the central or high-pressure cylinder, then expands into the large one that surrounds it, and is then condensed upon the principle commonly known as Woolf's. An engine thus arranged he denominates an "annular expansive condensing steam engine." *Patent completed.*

2429. R. Waygood. *Improvements in steam boilers.* Dated September 2, 1862.

This invention consists in constructing boilers in which vertical tubes, by preference tapering towards their upper ends, lead the products of combustion directly upon the bottom of a water space extending nearly across the boiler. The products of combustion are caused to ascend over the upper part of the water space, and in doing so, impinge against tubular water spaces. The products of combustion from each side of the transverse water space meet, and, if required, are made to pass upwards through other vertical tubes, impinge against the bottom of another transverse water space, and so on as before, according the height of the boiler. *Patent abandoned.*

2430. W. Roberts. *Improvements in apparatus for regulating the amount of water discharged by a pump, chiefly applicable for regulating the amount of water thrown by a steam fire-engine, or for regulating the amount of water fed to a steam boiler.* Dated September 2, 1862.

Steam fire-engines as at present constructed are only capable of throwing a jet of considerable diameter, and are unable to throw a jet of small dimensions, as if a small jet be used, the speed of the engine is so much reduced that it cannot work properly, and stops on its centres. Now, according to this invention, the patentee (in the case of double acting pumps) makes a passage between the two extremities of the pump cylinder; in this passage a valve is placed, by which the passage can be entirely closed. When the pump is required to throw as large a jet as possible, the valve is closed, but when a small jet is required, the valve is partly opened; a portion only of the water forced by the piston from one end of the cylinder will then pass away through the jet, the remainder passing through the passage, and entering the cylinder at its opposite end, so that a less quantity of water will be drawn through the suction pipe. *Patent abandoned.*

2431. J. B. Thompson. *Improvements in electro-magnetic machines.* Dated September 2, 1862.

This invention consists in a mode of applying the enormous attractive force of the electro-magnet to the movement of machinery. The electro-magnet may be employed directly to produce a rectilinear oscillating motion; but as the force of the electro-magnet is effective only at a very short distance, the oscillations are too short to apply the great power in any beneficial way for moving machinery, hence almost all attempts hitherto made at applying electro-magnetic force have been in rotary engines, but these machines, even when of the largest size, have produced but small effects. The difficulty to be overcome is to apply the direct pull of the magnet, and at the same time to obtain sufficient length of stroke. This the patentee has done by combining a number of electro-magnets into a series, the electro-magnets being placed one beyond the other, and having their opposite poles at very short distances from each other, so that when the current passes the electro-magnets attract simultaneously. By this means he gets the full force of the electro-magnet, and by adding to the number in the series of magnets, he gets any desired length of stroke. This series of magnets is in imitation of a muscle in the animal body, short magnets representing the striæ of the muscles, and they contract in a similar manner, being really an iron muscle. *Patent completed.*

2432. Sir W. O. S. Brooke. *Improvements in the construction of submarine telegraphic cables.* Dated September 2, 1862.

The object of this invention is so to construct a marine telegraphic cable for deep sea lines that its specific gravity, and, consequently, its rate of sinking as it is laid can be regulated with precision; and a farther object of the means of construction which the inventor adopts is the protection at the same time of the telegraphic core against friction and other ordinary causes of mechanical injury. The objects are attained by the use of wooden tubes, which are threaded on to the telegraphic core. For the construction of the tubes American beech is preferred, impregnated with drying oils or melted paraffine under great pressure. The usual length of the tubes is four inches, and the usual diameter one inch, but these dimensions may vary, and other woods may be used. The core is enclosed in hemp or silk lines rendered waterproof and preserved by any suitable preparations, and coated with tape. Between the ends of the wooden tubes are interposed elastic discs or joints of caoutchouc, flexible or vulcanized canvas prepared with caoutchouc, leather or hemp saturated with paraffine, wax, marine glue, or other oleaginous or resinous substances, or other flexible material may be employed, the object being to give flexibility to the cable with due protection to the core. To regulate the rate of sinking, there may be interposed at certain intervals tubes of iron-wood, lignum vitæ, or other dense woods, or of marble, instead of the ordinary tubes of wood lighter than sea-water. *Patent abandoned.*

2433. A. Johnston. *Improvements in machinery for pressing cotton and other materials, and in bands for retaining the same in bales.* Dated September 2, 1862.

The lever presses heretofore used for pressing cotton have usually been arranged in such manner that the cotton to be pressed is fed into a box into which a plunger can be caused by the lever to descend vertically, and a counterbalance weight is used to counterbalance the weight of the plunger and levers connected to it. According to this invention, the patentee combines together two lever presses in such manner that the plunger of one press shall be ascending whilst the plunger of the other press is descending, the two plungers thus balancing each other. He also prefers to arrange each press in such manner that, after the cotton or other material has been compressed by the descending plunger, the bottom of the case in which the material is contained shall be forced upwards by hydraulic pressure, and in order that the levers of each press may in turn come into a suitable position to withstand the pressure thus put on them, he arranges the two combined presses in a special manner. *Patent completed.*

2434. C. Garion. *An improved method of applying heat in the manufacture and refining of sugar, and in malting, hop drying, brewing, distilling, and vinegar-making.* Dated September 3, 1862.

This invention consists in employing hot water or other fluid as the heating medium, the heat being sustained by self-acting circulation through pipes from a boiler, either contiguous to, or at a distance from, and at a lower level than the subject to be acted on. *Patent abandoned.*

2435. H. Elliott. *A new or improved instrument or apparatus for extracting the cases of pin cartridges from breech-loading firearms, and for recapping, recharging, and closing or turning in the said cartridge cases.* Dated September 3, 1862.

This invention consists of an instrument or apparatus composed of the following parts:—A long hook on the end of a rod is jointed by the said rod to a handle of nearly the same form and construction as that of the ordinary pocket cork-screw. When the instrument is closed, the hook occupies the space between the two sides of the handle, and the hook is held firmly both in its open and closed positions by the spring joint. On that end of the rod which is jointed to the handle, two holes are made at right angles to one another, one of the said holes being in the axis of the rod, and the other being situated across the rod. The former hole is screwed and opens into the latter, which is plain. Into the screwed hole a plug is made to screw, which plug serves to force down the charge in recharging the cartridge case, and also serves to take hold of the pin of the cartridge case in withdrawing the said pin from the said case. The plain hole also serves to draw the cartridge case from the barrel by introducing the pin of the cartridge case into the said hole. In the said screwed hole a cupped closer also screws for closing in the end of the cartridge case after it has been charged. In order to recap the cartridge case, the inventor employs a metal cylinder a little less than the interior of the case. The said cylinder has a hole in its axis, up which the hook can be passed. At the top of the cylinder is a lateral hole, through which the percussion cap is passed, and held between two springs. The cylinder, with the hook and cap in it, is passed up the cartridge case, and the hook being pressed up the cylinder, the percussion cap is forced into the recess in the end of the cartridge case. The pin is now placed in the side of the cartridge, and by turning the handle of the hook upon its joint, the said handle may be pressed against the end of the pin, and made to force the said pin into the percussion cap. When the metallic end of the cartridge case has been separated from the paper tube by the discharge, the said metallic end is drawn out by the pin, and the paper tube or case which is left behind is drawn out by the long hook. By the use of the instrument described, a pin cartridge case can be withdrawn from a breech-loading firearm after discharge, and can be recapped and recharged and closed ready to be used again. *Patent abandoned.*

2436. F. C. Bakewell. *Improvements in fire-places and stoves.* (A communication.) Dated September 3, 1862.

This invention consists of certain improvements in fire-places and stoves, to effect the following objects:—1. To obtain more perfect control over the combustion of the fuel, so that the fire may be made to burn up and give out a great amount of heat, or to burn very slowly, as desired. 2. To effect a saving of fuel. 3. To prevent the soot and fine ashes from passing from the chimney and fire-place into the room. The patentee claims—1, the use of air-passages or recesses in the back wall of the grate extending from below the fire-basket to any desired height above the grating on which the fuel is placed. 2, the use of flaps, or other equivalent device, for closing at pleasure the spaces between the grate bars, on which the fuel rests, for the purpose of preventing the rapid combustion of the fuel. 3, the use of a screw placed over the smoke flue for the purpose of preventing the fall of soot and dirt into the apartment, and for conducting those substances to suitable receptacles from which they may be removed from time to time. 4, the combination of the air flue, dust pipes, and screen described, or any of them, with a fire-place or stove, for the purposes set forth. *Patent completed.*

2437. G. Walton. *Improvements in circular box looms.* Dated September 3, 1862.

This invention has for its object the prevention of the recoil of the shuttle box when moved by the ordinary apparatus, in order to bring the shuttles contained therein successively into their required positions for being driven across the loom, and the consequent increase in the speed at which the loom may be worked. For this purpose, a spring catch is adapted, and applied to the ordinary disc, which spring catch is caused to retain the box in the position into which it is brought by the action of the ordinary apparatus, thereby preventing the recoil from the action of the same. *Patent abandoned.*

2438. W. H. Atkinson. *Improvements in studs or fastenings adapted to holding together parts of shirt fronts, wrist bands, collars, gloves, and other articles of wearing apparel.* Dated September 3, 1862.

By one adaptation of this invention the studs are formed in two parts. To one of these parts is applied the shaft or pillar, which is formed hollow, and with an internal neck or shoulder adapted to receive a stem attached to the other part of the stud, which is held therein by means of a spring, with a notch or notches acting on the neck or shoulder of the hollow stem, and capable of being readily acted upon to release them when necessary. By another arrangement the stems of the respective parts are held one within the other by screwing, aided by spring pressure. By another arrangement, a dovetail-piece is applied to the stem or shaft of one part of the stud adapted to slide into a corresponding recess in the other part, and to be retained there by a spring. By these means a simple round eyelet-hole will alone be necessary, in place of the long button hole now used to receive such studs. *Patent abandoned.*

2439. W. Clark. *Improvements in musical instruments.* (A communication.) Dated September 3, 1862.

This invention consists—1, In the application of an inner tube capable of receiving rotary motion to musical instruments, such as hautboys, flutes, clarionets, and others, and serving to produce the chromatic scale. 2, In the application of an exterior cylindrical tube sliding in either direction, also serving to produce the chromatic scale. By these means the inventor is enabled to produce several tones with the same instrument without change of the fingering. According to the first method each key has two actions or two stops for an instrument with two tones, such as a hautboy, flute, or clarionet, and when one or other tone is played all the holes of the other tone are closed by rotating the interior tube. In the second arrangement, the cylindrical exterior tube which slides up and down the instrument also produces the chromatic scale by the application of a double row of holes in the body of the instrument, in such manner that, by sliding the exterior tube up the instrument, the latter will be raised a half tone higher, and by sliding it in the contrary direction, the first row of holes being closed, those holes which remain uncovered return the instrument to a lower tone. In the latter arrangement, the parts are very simple, and the same as those in ordinary use. *Patent abandoned.*

2440. E. Dyson. *Improvements in throstle spinning and doubling machines.* Dated September 3, 1862.

This invention relates to spinning and doubling machines of the character of the throstle, and to such machines as have a moveable spindle rail which also acts as the copping rail. Hitherto in such throstle spinning and doubling frames the moveable spindle and copping rails have been separate and independent of each other, and by the pull of the bands driving the spindles the moveable copping rails have been forced entirely to one side, causing considerable friction upon the slides, and unsteady and irregular motion. This invention consists in connecting the moveable spindle rails on each side together by a bar or by brackets secured to the rails, by which means the pull of the bands or force acting upon the spindle rails on one side of the frame, will be counterbalanced by that acting upon the spindle rails on the other side of the frame, and thus friction upon the slides is obviated, and the moveable spindle rails are kept true, steady, and free from irregularities in motion. *Patent completed.*

2441. R. A. Brooman. *Improvements in tools for boring, and in apparatus for working the same.* (A communication.) Dated September 3, 1862.

This consists in the construction and use of tubular tools armed with diamond cutters to which rotary and advancing motions are communicated. *Patent completed.*

2442. R. A. Brooman. *Improvements in apparatus for transmitting electric telegraph messages and signals.* (A communication.) Dated September 3, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2443. P. J. Bossard. *Improvements in stoppers for bottles, jars, guns, tubes, and other mouthed articles in taps, and in fixing them in casks and other vessels.* (A communication.) Dated September 3, 1862.

This invention is not fully described apart from the drawings. *Patent completed.*

2444. J. Cook. *Improvements in carriages.* ' Dated September 4, 1862.

This invention consists in constructing two-wheeled carriages so as to admit of their being coupled longitudinally, and employed together as four-wheeled carriages, space being left between the couplings of the fore and hind wheels for the object of the lock or turning, whereby wheels of a large and uniform size may be used throughout in connection with cranked or plain axles, and the said carriages coupled either singly or in sets. *Patent abandoned.*

2445. B. F. Cowan. *Improvements in cannon and other firearms.* Dated September 4, 1862.

In carrying out this invention the patentee employs a loading chamber or cartridge case, which he calls a thimble, because it has the general shape of a thimble. This thimble is a hollow metallic or other suitable tube, open at one end, that towards the muzzle of the gun, and closed at the other end, that towards the breech of the gun. The sides of this thimble taper slightly towards the open end. There are two or more slits in the sides of the thimble, running from its open end towards the breech end, but stopping at a suitable distance from the breech end, so as not materially to diminish the strength of the breach end. These slits of course make the sides of the thimble more or less flexible, so that the bore of the thimble towards its open end can be expanded by an internal or contracted by an external force. This thimble contains the whole of the charge of powder or other explosive material, and may contain also, as may be found convenient, the whole or the rear portion of the projectile or shot. When the explosion takes place, the gases thereby generated expand the thimble, and cause a proportionate amount of frictional pressure against the breech chamber, that is, the inner surface of the sides of the gun surrounding the thimble, so that the expansive force of the ignited charge is thus employed to counteract its tendency backwards. He further secures the thimble in its place by some suitable external application. The charge may be exploded in any of the usual ways; but he prefers the central forward ignition, and a thimble so arranged may be applied to any of the existing breech-loading small-arms, which are fitted for central ignition. For the purpose of obtaining such ignition he employs the second part of the invention, which consists in the nipple, or other conductor of the spark to the powder, being so placed, or so arranged that the charge is ignited at the centre of its front portion. When so ignited the expansion of the thimble is obtained most rapidly, and no portion of the charge can be blown out of the gun without being ignited, while the fouling is also left in the thimble and removed with it. The piece is discharged by withdrawing the mandril so far as is requisite, and thus releasing it, on which it is forced forwards by the spiral spring, so as to strike and explode the cap. If it is desired, by adding on to the mandril a stud working into a slot in the handle, the piece can be placed either at half or at full cock. *Patent completed.*

2446. W. Clark. *Improvements in the manufacture of colouring matters.* (A communication.) Dated September 4, 1862.

For the purposes of this invention the inventor takes equal parts of aniline, red and crystallized tolnidine, and heats them for five or six hours at a temperature not exceeding 324 deg. of Fahrenheit, and of not less than 270 deg., after which time a paste of a beautiful blue colour is produced, of a slightly violet hue. This raw paste contains besides the blue colouring matter traces of red which has not become changed, and also an excess of tolnidine. In order to purify it, he boils the paste with dilute sulphuric or muriatic acids, which form salts very soluble in tolindine and red aniline, without injuring the blue. A mixture of one part of common muriatic acid with eight or ten parts of water is preferable for effecting this purification. The matters are boiled in the diluted acid until there is no longer any trace of red colour in the washing waters. The insoluble residue will be pure blue, which may be used for dyeing and printing. *Patent completed.*

2447. J. Platt and W. Richardson. *Improvements applicable to the burning of bricks, tiles, and other articles of earthenware.* Dated September 4, 1862.

This invention consists in a method of heating a filled kiln in a preparatory manner, and this the patentees accomplish by transferring thereto the heat from a separate kiln in which the burning of the bricks or other articles has been effected. For this purpose they employ a blast of air which passes from the top of the heated kiln to the lower part of that in which the articles to be burnt are placed. *Patent completed.*

2448. H. L. Emery. *Improved machinery for ginning cotton.* Dated September 4, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2449. R. P. Coles. *Improvements in the construction of the permanent way of railways.* Dated September 4, 1862.

This invention relates to an improved railway chair, and the mode of securing the same in the permanentyway of railways, whereby greater steadiness and durabilit is obtained, and the cost of maintaining and renewing the permanent way of railways is considerably reduced. This invention proposes the use of an iron chair (cast iron is preferred) made hollow in the upper part, and slightly tapering upwards in the transverse section; into this hollow are fitted two wooden wedges, the upper one entirely fitting into the upper portion of the cavity of the chair, and is forced into its position by the lower wedge (it is preferred that the wedges are kiln dried). The chair with its inclined wedges is then to be placed at intervals, and embedded in concrete of the ordinary composition, and made level with the upper surface of the chair, and forming a continuous bearing surface for the support of any of the well-known flanged rails. Through the flange of the rails screws are passed, securing the rails to the wedges in the upper portion of the chair, and between the flange of the rails and the concrete is interposed a continuous surface of wood or other elastic packing, to relieve the concussive action of the passing load. At intervals, wrought-iron tie-rods are made to pass through holes in the two corresponding chairs, and secured by a nut, to prevent the lateral spread of the gauge. *Patent completed.*

2450. J. Platt and W. Richardson. *Improvements in the preparation of clay for the manufacture of bricks, tiles, and other articles which may be made of such material.* Dated September 4, 1862.

The apparatus for carrying out this invention is not described apart from the drawings. *Patent completed.*

2451. W. Slater and W. R. Harris. *Improvements in self-stripping carding engines for preparing cotton or other fibrous substances or materials.* Dated September 5, 1862.

This invention relates to those machines known as self-stripping carding engines, and consists in the employment of a combination of mechanism for the purpose of raising and lowering the top flats of carding engines at a varying rate or speed, namely, to raise and lower and strip or clean those which are nearest to the "licker-in" or feed rollers at a quicker rate than those which are nearest to the doffer. *Patent abandoned.*

2452. W. E. Bovill. *An improvement in the mode of applying oil and other fluid lubricators to machinery.* (A communication.) Dated September 5, 1862.

The oil cup is, according to this invention, either formed or fixed under or at a lower level than the axle-bearing or machinery to which the oil or other fluid lubricating matter is to be applied. A wick or pad, or several wicks or pads, or a combination of both, possessing the property of capillary attraction, is inserted in the oil cup or reservoir, so that one end of the wick or pad shall touch the axle-bearing or machinery to be lubricated, and the other end shall dip into and absorb the oil or other lubricating matter. The wick or pad is supported by a collar or case of wood, metal, leather, or any rigid substance, and is kept in its place and in constant contact with the axle-bearing or machinery to be lubricated by a spring and guide, or other mechanical contrivance. The wick should, therefore, be made as narrow as possible, and supported and stiffened by the collar or case. And such oil cup or reservoir is to be made with a sloping bottom, and an aperture in the lower part closed by a screw plug, or any suitable mechanical contrivance, so that the detritus, dust, or other impurities may settle in the lowest part, and so as to allow the cup or reservoir to be cleansed when requisite, without dismounting the axle-bearing or machinery or the cup. *Patent completed.*

2453. H. W. Hart. *Improvements in argand and other burners.* Dated September 5, 1862.

An extension of time for filing the final specification of this patent having been petitioned for, the documents relating to the invention cannot at present be seen. *Patent completed.*

2454. D. R. Samuel. *Improvements in apparatus for steering vessels.* Dated September 5, 1862.

In carrying out this invention, the inventor proposes to reverse the tiller of the rudder by making it point "aft" instead of "fore," as is usual, the end of the tiller being provided with a vertical pin and roller which acts in a groove cut in a double-action lever; this lever works on a centre pivot, and is forked at its fore-end so as to receive a block of metal to slide in slots, through which block a screw works, being set in bearings on each side of the deck; thus, when motion is imparted to the screw by means of a steering wheel, the block and lever are brought from the centre of the ship to the side required, and, consequently, the rudder is turned accordingly by the other extremity of the lever, the greater power being gained where most required, the difference in the lever being greater as the rudder is moved towards either side. The steering wheel may either be attached to the end of the screw at the side of the ship, or may be placed in the centre of the deck, bevelled wheels being employed to actuate the screw. *Patent abandoned.*

2455. J. S. Margetson. *Improvements in the manufacture of the material intended for scarfs or cravats, and the machinery employed therein.* Dated September 5, 1862.

In carrying out this invention, the patentee arranges in the loom a single warp of fine silk or other material, and he forms a double series of wefts of silk or other material of the various desired colours, wound on bobbins in shuttles, one series of such shuttles being worked on a higher lever than the others, and which are thrown across the warp by hand or steam power, whereby the warp is buried between the wefts, and a different series of stripes and colours is produced on each side of the fabric, according to the colours of silk or other materials in the shuttles; and in some cases he employs gold or silver thread to form some of the stripes. The result of this arrangement is that he produces a twilled fabric twilled on both sides, having a striped pattern of any number of colours, and of various widths on both sides of the cloth, the patterns being totally different from each other. *Patent completed.*

2456. W. Wells. *Improvements in horse shoes and in the method of fastening the same.* Dated September 5, 1862.

In carrying out this invention the inventor proposes to form a plate or false shoe of malleable iron, of the size and form of the hoof, the same having holes pierced therein corresponding with those in the shoe itself; the shoe is to be nailed to this plate, and the ends of the nails turned over and broken off, thus securing the shoe to the plate. This plate has side clips and a toe clip, the toe clip being pierced with a hole for the purpose hereafter described; the back of the plate or false shoe is provided with a metallic strap, on one side of which is a stud, and on the other a boss through which a screw passes; this screw works into a nut on a band passing from the lower part of the heel round the upper and front part of the hoof, the other end of the said band passing over the stud before-mentioned; the band is also pierced in front to allow of a hook to pass from it down to the front of the plate or false shoe, so that when the screw is actuated the plate band and hoof become simultaneously tightened. *Patent abandoned.*

2457. W. E. Newton. *Improvements in lamps.* (A communication.) Dated September 5, 1862.

The object of this invention is to construct a lamp adapted to convert hydro-carbon oil, camphine, or other liquid lighting material into gas, and to burn the gaseous product in a separate illuminating frame apart from the wick without the use of a chimney. The invention particularly consists—1, in an improved manner of forming and applying the deflector by which air is furnished to the flame in the most advantageous direction and condition. The invention consists, 2, in an improved device for supporting the deflector adjustably upon the wick tube; 3, in a device for supporting a reflector or other article to be used in connection with the lamp or a nursery cup or vessel to contain water or liquid that may be heated by the flame of the lamp. *Patent completed.*

2458. S. H. Hadley. *An improved process for manufacturing gas for illumination.* Dated September 5, 1862.

The patentee claims the production of permanent illuminating gas by the decomposition of steam and volatile hydro-carbon in the state of vapour, the steam and hydro-carbon vapour being mixed while the hydro-carbon is in the nascent state by subjecting such mixture to the action of red hot carbon as described. *Patent completed.*

2459. J. R. Johnson and J. A. Harrison. *Improvements in apparatus for taking photographic panoramic pictures.* Dated September 5, 1862.

This invention consists, 1, in an improved construction and arrangement of the parts of the flat plate camera, so that their motions are smooth and free from vibration, and so that the whole apparatus is rendered more compact and portable than those previously suggested. 2, in a new mode or modes of obtaining the relative motions of the lens and sensitive plate, such motion being obtained directly by mechanical means, or by appliances constructed mechanically instead of by guide curves or grooves formed by trial, as has heretofore been proposed to be done. 3, in an improvement in the gearing when working both forms of camera. 4, in the application of a spring or weight to give motion to such cameras, and in means for regulating such motion both at variable and invariable rates. 5, in the application of an expanding diaphragm to regulate the exposure in cameras moving at an invariable rate. 6, in an expanding diaphragm to be placed between the lens and the sensitive plate, by means of which sky and cloud effects may be obtained, and by which the amount of exposure may also be regulated. *Patent completed.*

2460. S. H. Huntley. *Improvements in cooking apparatus, more particularly applicable to the requirements of the army and navy.* Dated September 6, 1862.

The patentee claims—1, the construction of cooking apparatus having two or more boilers, and one or more ovens placed between the boilers, and in which both the boilers and the oven or ovens are heated by the same fire or fires, substantially as described with reference to the drawings. Also the combination of such apparatus with a hot plate or open fire for roasting and boiling. 2, the construction of cooking apparatus in which two or more boilers are fixed inside a casing, and an oven or ovens above and between the boilers, access being gained to the boilers on either side of the oven or ovens, and in which the draught from the fire or fires is caused first to pass along the bottom surface of the boilers, and then to cirtulate over the greater part of the surfaces of the oven or ovens on its way to the chimney. Also, the adaptation of such apparatus to field purposes by affixing a store box, wheels, and shafts to the same. *Patent completed.*

2461. J. Schnider. *A new and useful method of increasing the durability of, and for preserving, cloths and other like fabrics used for sails, tarpaulings, tents, and other coverings, &c.* Dated September 6, 1862.

This invention consists in applying to the above, and various other fabrics, a composition, or paint, of which graphite is the chief base. *Patent completed.*

2462. S. Pudney. *Improvements in apparatus to be used in the manufacture of sulphuric acid.* Dated September 6, 1862.

This invention consists in improvements in the construction of sulphuric acid chambers. These chambers are commonly constructed of sheet lead, the floor, walls, and roof of the chamber being of this material. Now, according to this invention, the patentee employs sheets of glass in the construction of the parts of the chamber. We cannot quote the details. *Patent completed.*

2463. H. Hughes. *An improved frilled and fluted fabric or material, and improvements in fluting or goffering machines.* Dated September 6, 1863.

The improved frilled and goffered fabric is composed of a material, say ribbon; it may be all of one colour, or of different colours, and may be made of similar or dissimilar materials, that is to say, for example, the body may be made of velvet and the edge or edges of silk, or the body of linen and the edge or edges of cambric, or the whole may be made of paper. The patentee forms the improved fabric by goffering the material which is to constitute the the edge or edges of the material in a goffering machine with plaits or goffers; and next sews, by preference, in a sewing machine, the bottom edge of this goffered edging on to one edge of the material which is to form the body, taking care that all the plaits are secured thereto. Both edges of the body may have similar goffered material sewn to them, or one edge only may have the goffered material sewn to it, while the other edge has a piece of plain material sewn to it, or not, as desired. The patentee then takes the body and the goffered edge, and passes the whole through a fluting or goffering machine similar to that for which letters patent were granted to the inventor, May 29 (No. 1327), but with the leaves, or pattern formers, so made as not to injuriously affect the already-goffered edging. The effect is to produce a fluting or goffer across the whole fabric, including the goffered edging. Lastly, the inventor runs one or more rows of stitching through and along the fabric, in order to preserve the fluting. *Patent completed.*

2464. E. L. Duncan. *Improvements in the manufacture of splints.* Dated September 6, 1862.

In carrying out this invention, the patentee proposes to form splints of a strong fabric padded with wool or cotton wadding, or with layers of any soft fabric; or the padding may in some instances be dispensed with. He also applies and fastens to the back of these splints (in order to maintain their position and strength) any kind of cane, such as ratan, bamboo, or jungle cane, either split or entire, and in longitudinal rows or layers, the cane being sewn in under the material forming the back of the pad, which then presents a fluted or grooved surface; or the cane may be wound or interlaced so as to unite their series in a parallel position, and thus obviate the necessity of padding. *Patent completed.*

2465. J. H. Johnson. *Improvements in firearms and projectiles.* (A communication.) Dated September 6, 1862.

This invention relates to certain improvements in firearms, which improvements are partly applicable to breech-loaders and partly to muzzle-loaders, whether rifled or smooth-bored, and also to a peculiar form of bullet suitable for rifled firearms of all kinds. We cannot quote the details. *Patent completed.*

2466. W. J. Curtis. *An improved construction of breech-loading cannon.* Dated September 6, 1862.

In carrying out this invention, the inventor mounts the breech of the gun within a curved frame, through the forward ends of which pass the trunnions of the barrel or main portion of the gun. This curved frame is further secured to the barrel by a strap piece, whereby, when it is required to elevate or depress the gun, the barrel and frame will rock together on the axis of the trunnions. A vertical adjusting screw from the gun carriage, bearing upon the under side of the curved frame, is provided to effect the vertical adjustment. The sides of the curved frame are pierced with elongated inclined holes, which are intended to receive the trunnions of the moveable breech piece. This breech piece is so hung as to balance itself, or nearly so. This arrangement necessitates but little exertion from the gunner to move it into or out of line with the barrel. On one of the trunnions of the breech piece is a lever, or it may be a spanner, for operating the breech piece, and turning it into a vertical position ready to receive the charge. When charged, the breech piece is again rocked on its trunnions, and having been brought into a line with the barrel, it is forced home by a binding screw that lies in a line with the axis of the gun, and is worked by a hand lever. This screw is tapped into the rear of the curved frame before mentioned, and is operated by a hand lever. It bears in the rear of the breech piece, and its action is to force the breech piece into close contact with the barrel, and thereby close the joint between them. The better to ensure a close joint, a portion of the contact surface may be coned, and thus an interlocking of the parts will be effected. If thought desirable, soft metal packing may be introduced between the contact surfaces. *Patent abandoned.*

2467. W. A. Richards. *An improved fastening.* Dated September 6, 1862.

One portion or member of this fastening consists of three plates, two of which are fixed, but the outermost or uppermost is capable of sliding to and fro on or over the next, and carries on its under or inner side a slotted piece which projects through an aperture in the second or middle plate, and works on or over the third plate, the plates being disposed accordingly. This slotted piece is so constructed that there is a recess or space between its slotted part or surface and the sliding plate that carries it. The slot in the projection is of a shape resembling a keyhole, having a narrow portion leading into a broader portion. The third plate which is the undermost or innermost has also an opening or orifice in it. The other portion or member of the fastening is a catch, pin, stud, hook, or piece hereinafter called "catch" or "pin," which the patentee prefers to form as a pin or stud with lateral recesses or niches in the body. The aperture in the third or undermost or innermost plate is of sufficient size to admit the head top or free end of the catch. To close the fastening, this head top or end is first admitted through the third plate, and through the broad portion of the slot in the slotted piece, and the sliding piece is then moved so as to bring the narrow portion of the slot over this aperture. While in this position the plates cannot be released from the catch. To open the fastening, the sliding piece is moved to bring the broader portion of its slot over the opening in the undermost or innermost plate, whereupon the plates will be disengaged from the catch. *Patent completed.*

2468. C. W. Williams. *Improvements in steam boilers.* Dated September 8, 1862.

This invention is designed to increase the evaporative or vapourizing effect of steam boilers, and consists in substituting for the ordinary long tubes or flues employed in locomotive marine and other steam boilers, sets or series of short tubes or flues of a circular, rectangular, or other form at short distances apart, the ends of each set or series being fitted into tube plates or face plates, like those into which the long tubes aforesaid are united. The object of this arrangement is to increase the number of tube plates or face plates against which the flame of hot gases generated in the furnace strike, as the patentee has found by experiment that tube plate or face plated surface exposed to the direct action of the flame and hot gases is much more efficient than the interior surface of the tubes themselves in transmitting heat to the water within the boiler. *Patent completed.*

2469. F. D. Artingstall. *Improvements in balances.* Dated September 8, 1862.

This invention relates to weighing machines and other balances, and consists in employing thin plates of steel or other suitable metal instead of the knife-edged centres now generally used. The said plates bear the weight above them by thrusting, and as the plates are flexible they allow motion to the levers or arms of the balance or steelyard, but as that motion is only delicate through a small space or angle which it is difficult to perceive, the patentee makes it the more clearly perceptible by fixing to the arm of the steelyard or balance a spirit level, which indicates a very small disturbance of the level or equilibrium. Or he employs a multiplying lever to multiply the motion of the balance by making the head of the balance high and heavy. *Patent completed.*

2470. J. S. Crosland. *Improvements in the manufacture of tubes made of copper, and of copper combined with other metals.* Dated September 8, 1862.

This invention consists in casting the said tubes in hot dry sand, or hot metal moulds, with hot dry sand or loam cores in a vertical or inclined position, pouring the metal into the mould from the top; chaplets or thickness stops or wedges of copper or other metal are placed between the core and the mould. *Patent abandoned.*

2471. J. Whitehead. *Certain improvements in looms for weaving.* Dated September 8, 1862.

This invention consists—1, in certain improvements on a former patent granted to the present patentee on the 10th day of June, 1861 (No. 1470), whereby the chain drums referred to in the specification of the said patent may be moved in either direction, backwards or forwards, as may be required. 2, in an arrangement of mechanism for varying the quantity of fabric taken up, such invention being governed by the shuttle-box then in working condition. 3, in an arrangement of mechanism for preventing the stopping of the loom by the weft fork when the weft is withheld for the purpose of making a fringe, or for other purposes. *Patent completed.*

2472. J. Hartshorn and W. Redgate. *Improvements in means or apparatus for the manufacture of lace fabrics.* Dated September 8, 1862.

This invention relates to means for the production of what are called scolloped edges, and also extensions or contractions to holes and other parts of lace fabrics. For this purpose, in addition to the ordinary points, the patentees employ another or other bars of points below the ordinary points, and such extra point bars, in addition to their backward and forward motion are capable of endway motion; regulated by jacquard or other pattern surface, so that these points may operate upon threads to draw them sideways to the extent desired, and they are placed in position to enter between the threads just above the carriages, when the desired endway motion may be given to such extra points to draw the threads sideways till taken and held by the ordinary points, and so on until the desired deviation from the otherwise regular course of threads has been attained. *Patent completed.*

2473. C. Fink. *An improved turbine.* Dated September 8, 1862.

This improved turbine is constructed with a fixed outer ring of adjustable direction vanes, contained between two parallel horizontal annular surfaces, between which adjustable vanes the actuating water passes, and is directed by them into and through a series of buckets or openings formed with or attached to a ring or wheel attached to a shaft or spindle, and free to revolve within the ring first-mentioned. The actuating water, after passing through the buckets of the inner ring or wheel (and twereby giving a rotary motion to the same and to the shaft or spindle upon which it is fixed), passes downward through a suitably-formed pipe or tube, from which it is ultimately led away in any convenient manner. *Patent abandoned.*

2474. G. W. Belding. *Improvements in machines for forcing fluids and dirt from cloth and other fabrics.* (A communication.) Dated September 8, 1862.

This invention relates chiefly to novel means for rendering the machines self-adjusting; to the method of attaching the machines to the washing tub or vessel; and to the arrangement and combination of the parts, whereby the machines are rendered less expensive, and more durable and efficient than those heretofore invented. We cannot here quote the details. *Patent completed.*

2475. G. Davies. *Improvements in railway signals.* (A communication). Dated September 8, 1862.

This invention has for its object the placing beside the rails (at a suitable distance from the stations) of a detonating signal requiring no change of the customary usages, capable of being put in action from the station, and infallible in effect. *Patent abandoned.*

2476. A. J. Alderman. *Improvements in ships' windlasses, capstans, and cable stoppers, applicable generally to hauling and working with chains.* Dated September 8, 1862.

This invention consists, 1, in an improved cable stopper, by which the cable can be held firmly, its paying out checked and controlled, and the ship gradually brought up without any sudden pull or jerk upon the cable. The invention consists, 2, of a whelp of improved construction, by which the overlapping or riding of one link of the chain upon another, and the jamming of the cable against the bits are prevented, and a greater hold of the cable upon the barrel of the windlass is obtained. *Patent completed.*

2477. J. Webster. *Improvements in preventing the incrustation of steam boilers.* Dated September 9, 1862.

This invention consists in placing in steam boilers a surface of tow, hemp, jute, cotton waste, or other fibrous and absorbent substances, wherein the earthy matter caused by evaporation is deposited. *Patent abandoned.*

2478. P. Rainer. *Improvements in watches, chronometers, and other timekeepers.* Dated September 9, 1862.

The object of these improvements is, that whilst the watch, chronometer, or other timekeeper by the hands or pointers is set to indicate Greenwich or other particular time, it may also by the same hands or pointers indicate other local time or times. For this purpose, in addition to a fixed dial for moveable hands or pointers, as heretofore, and which may indicate Greenwich or other particular time, the inventor applies another series of figures upon a separate rim or surface, which may be shifted round the centre of motion of the hands or pointers, and yet be held in grooved or other guides, and retained as set by spring or other stop, so that the respective figures of such extra series may, in their relation to the other set of figures, indicate the difference of time between any two distant places. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Nov. 15, 1862.

3072. C. Binks, Parliament-street, Westminster. Improved methods of, and apparatus for, treating linseed and other oils and fats.

Dated Feb. 17, 1863.

431. E. Deville, 95, Rue Blanche. Improvements in floating or life-preserving coats or garments. (A communication.)

Dated Feb. 24, 1863.

499. J. Clay, Sparkhill, near Birmingham, saddler. Improvements in the manufacture of saddles.

503. J. W. Burton, Leeds, gentleman. Improvements in the bearings and leashes of axles and shafts.

Dated Feb. 26, 1863.

535. H. Edmonds, M.D., surgeon, Royal Navy, Peel Lodge, Stoke-road, Gosport. Improvements in the ventilation of ships and vessels, and apparatus connected therewith.

Dated Feb. 27, 1863.

550. W. Stauffen, George-street, Portman-square. A new or improved fibrous substitute for human and other hair, to be used for all the purposes for which human and other hair is now used, and also for the manufacture of textile fabrics.

556. R. A. Brooman, 166, Fleet-street, patent agent. A new method of, and apparatus for, boring into water and gas supply pipes, and fixing branch pipes therein. (A communication.)

560. V. D. Delahaye, civil engineer, 7, Cauchoise-street, Rouen. Improvements in apparatus for cleaving and excavating pit coal and rock or earth.

Dated March 2, 1863.

586. W. Clark, 53, Chancery-lane, engineer. Improvements in preparing and obtaining photographic impressions, and in the application of such improvements. (A communication.)

Dated March 3, 1863.

594. G. Price, Cleveland Safe and Lock Works, Wolverhampton, iron safe and lock manufacturer, and W. Dawes, Bolton, engineer. Improvements in burglar-proof safes and strong-room doors and frames.

Dated March 4, 1863.

605. J. De Keyser, Molenbeck St. Jean, Belgium. Improvements in treating petroleum oil, and in the combination thereof with other oils for lubricating and other like purposes.

Dated March 6, 1863.

620. E. P. Plenty and W. Pain, Newbury, Berkshire, agricultural engineers. An improved method of supporting screens and straw shakers, specially applicable to thrashing machines.

636. A. Wilson, 50, Lower Woodbridge-street, Clerkenwell, chair and cabinet maker. The better and more commodious manufacture of all kinds of easy, lounging, and invalid chairs, seats, or settees.

Dated March 9, 1863.

654. Sir A. Keller, Zurich. An improved apparatus for reeling silk direct from cocoons on bobbins.

Dated March 11, 1863.

660. R. T. Monteith, St. Malo, France, British Vice-Consul, R. Monteith, 64, Crystal-terrace, Cecil-street, Greenheys, Manchester, gentleman. Improvements in making dyes from aniline and its analogues. (A communication.)

Dated March 13, 1862.

680. H. B. Barlow, Manchester. Certain improvements in looms for weaving. (A communication.)

682. C. T. and A. Lutwyche, Birmingham, manufacturers. An improvement or improvements in metallic pens.

684. J. B. M. A. Bourreiff, 12, Rue des Petites Ecuries, Paris, manufacturer. Improvements in transferring by means of typography colours and metals on surfaces in general.

686. A. Wydler, Belfield Print Works, near Rochdale, calico printer, and C. Thornton, manager. Improvements in printing and dyeing woollen fabrics.

688. W. Smith, Little Woolstone, farmer. Improvements in machinery for cultivating land and sowing seed.

Dated March 14, 1863.

692. J. Page, Liverpool, civil engineer. Improvements in taps or valves.

694. J. Tangye, Birmingham, manufacturer. Improvements in portable hydraulic punching machines.

696. T. C. Richardson, Swansea, merchant. Improvements in the construction of ships.

698. R. Moreland, jun., Old-street, St. Luke's. Improvements in apparatus for making extracts of hops, and for selecting or separating the seeds and pollen from hops.

700. W. Boaler, Manchester, merchant. Improvements in the preparation of colouring matters for dyeing and printing. (A communication.)

Dated March 16, 1863.

704. W. Vernon, Nottingham, lace manufacturer. A new or improved means or apparatus for communicating signals or intelligence to or from railway trains or other similar conveyances, whether they be stationary or in motion.

706. T. Powell, 30, Prince's-terrace, Regent's-park. An improved chopping block for butchers.

Dated March 17, 1863.

712. W. H. Atkinson, Cavendish Club, Regent-street, gentleman. Improvements in studs or fastenings adapted to holding together parts of shirt fronts, wristbands, collars, gloves, and other articles of wearing apparel.

718. T. N. Miller, Bishop Stortford. Improvements in heating horticultural buildings.

Dated March 18, 1863.

724. F. Richmond, H. Chandler, and J. G. Richmond, Salford, agricultural implement makers. Improvements in machinery for washing potatoes and other vegetables.

726. H. Kilshaw, Haslingden, cotton spinner. Certain improvements in looms for weaving.

730. F. Norrington, Tavistock, Devon. Improvements in girths or bands and knee-caps for horses.

Dated March 19, 1863.

736. H. Wilde, Manchester, engineer. Improvements in the construction of steam boilers.

738. J. Saunders and J. Piper, Cookley Iron Works, Kidderminster. Improvements in apparatus employed in the manufacture of tin and terne plates.

740. C. Webster, New Radford, locksmith, and W. Forgie, Nottingham, lace cap manufacturer. Improvements in apparatus for the purpose of clearing out the interior of foul chimneys when on fire or otherwise.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated March 19, 1862.

734. G. Haseltine, 12, Southampton-buildings, Chancery-lane. Improvements in the manufacture of boots and shoes. (A communication.)

739. S. L. Croker, Taunton, Bristol. A new and useful or approved yellow-metal sheathing nail or spike, which, by means of a nail cutting engine, is cut from yellow sheathing metal.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, March 31, 1863.

3085. C. Binks. Obtaining oxygen and chlorine gases.

3087. W. Dobson. Lace dressing frames.

3089. W. Williamson. Washing, wringing, and mangling machines.

3095. W. H. Burnett. Working telegraphic lines.

3096. E. P. Houghton. Applying breaks or apparatus for stopping or retarding railway carriages.

3098. C. Neild and J. Hopkinson. In fire alarums, and indicators of temperature.

3105. J. Chalmers. The use, combination, and application of iron and timber as armour for vessels.

3109. R. A. Brooman. Tubular boilers, condensers, and superheaters. (A communication.)

3114. J. T. Hutchings. Construction of waterproof boot shoe soles.

3116. C. Stevens. Brickmaking machine. (A communication.)

3118. F. Fletcher. The arrangement of a vessel or vessels for the compression of air, as applicable to lift or force pumps.

3121. F. Seiler. Motive-power engines.

3126. C. Hadfield and W. A. Attkins. Compressing or dressing bricks and tiles.

3134. R. W. Swinburne. Manufacture of soda.

3136. J. Taylor, jun. Manufacture of tiles or moulded blocks.

3137. C. A. Orth. Apparatus for obtaining and applying motive power.

3139. A. Sutton. Time indicator.

3140. W. E. Gedge. Elliptical compass. (A communication.)

3141. W. E. Nethersole and C. Buckland. Safety signals.

3144. C. Powell. Watches.

3147. J. Webster. Burners and blow-pipes.

3159. A. L. Woolf. Metallic alloy.

3168. T. Fletcher. Construction of rollers, cans, spools, and bobbins.

3179. T. Keyworth. Motive-power machinery.

3180. W. T. Rawlett. Machinery used in producing knit or looped fabrics.

3184. W. Clark. Preservation of animal and vegetable substances. (A communication.)

3191. J. Cresswell and E. T. Greves. Construction of hearses and funeral carriages.

3197. A. Dudgeon. Packing for various parts of steam and other engines and machinery.

3223. B. Oldfield. Looms.

3224. A. V. Newton. Construction of steam and other vessels. (A communication.)

3285. P. Todd. Pickers.

3290. J. Hilliar. Hinges, joints, or connections.

3291. J. Hilliar. Ventilating.

3408. A. V. Newton. Automatic toy figures. (A communication.)

18. W. H. Muntz. Iron or other vessels.

154. G. Haycraft. Powder flasks.

391. J. Grantham. Hydraulic presses.

446. G. T. Bousfield. Breech-loading fire arms. (A communication.)

471. C. Malpas. Ovens or kilns.

479. W. Wood. Manufacture of confectionery.

521. W. Readman. Manufacture of carbonate of magnesia.

582. E. Habel. Preparing, spinning, and doubling fibrous substances.

636. A. Wilson. Chairs, seats, or settles.

688. W. Smith. Cultivating land and sowing seed.

731. G. Haseltine. Manufacture of boots and shoes. (A communication.)

739. S. L. Crocker. Yellow metal sheathing nail or spike.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed March 27, 1863.

2647. J. Addison.
2654. A. Prince.
2659. B. Donkin.
2671. R. Broadbent.
2673. W. Clark.
2678. J. and W. Lee.
2680. A. Barclay.
2681. W. E. Gedge.
2686. F. Watkins.
2687. F. E. Blatspiel.
2690. F. Johnson.
2692. R. Page.
2696. S. Holland.
2700. S. F. Cox.
2764. H. Bridson and J. Alcock.
2776. E. Molyneux.
2778. J. H. Jenkinson.
2713. P. Potenza.
2785. F. F. Prud'homme.
2822. N. R. Hall and M. L. Parnell.
3024. W. Clark.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

778. J. A. Maxwell.
783. J. H. Johnson.
784. J. Church.
798. J. L. Hancock.
805. S. R. Smith.
810. I. Holden.
820. J. Reidy.
826. W. M. Chambers.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

680. H. Brierley.
692. J. Robertson.
788. W. Roberts.
790. F. Grice.
814. R. Halliwell.
874. J. Mash.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending March 28, 1863.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2253	0 4	2317	0 10	2326	0 10	2336	0 4	2345	0 8	2353	0 4
2281	1 2	2318	0 4	2327	1 2	2337	0 6	2346	0 4	2354	0 4
2310	0 4	2319	0 4	2328	0 10	2338	0 10	2347	0 8	2355	0 4
2311	1 2	2320	0 4	2329	0 4	2339	0 4	2348	0 4	2356	0 4
2312	0 4	2321	0 10	2330	0 4	2340	0 4	2349	0 8	2357	1 4
2313	0 10	2322	0 6	2331	1 6	2341	0 8	2350	0 4	2358	0 10
2314	0 4	2323	0 10	2332	0 6	2342	0 4	2351	0 8	2359	0 4
2315	0 4	2324	0 8	2333	0 4	2343	0 8	2352	0 10	2360	0 10
2316	0 8	2325	0 8	2335	0 4	2344	0 10				

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRTION.

Timber, duty 1s. per load, drawback, 1s.

		£	s.	£	s.
Teak	load	14	0	15	0
Quebec, red pine		3	10	4	10
,, yellow pine		3	0	4	0
St. John, N.B., yellow		5	0	5	10
Quebec oak, white		5	10	6	10
,, birch		3	0	3	10
,, elm		3	10	5	0
Dantzic, oak		3	10	6	10
,, fir		2	10	3	10
Memel, fir		3	0	3	5
Riga		3	0	3	5
Swedish		2	10	2	15
Masts, Quebec red pine		5	0	6	0
,, yellow pine		5	0	6	0
Lathwood, Dantzig, fm.		5	10	6	10
,, St. Petersburg		8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					
Quebec, white spruce		15	10	19	10
St. John, white spruce		14	10	16	10
Yellow pine, per reduced C.					
Canada, 1st quality		17	0	18	0
,, 2nd do		11	0	12	0
Archangel, yellow		13	0	13	10
St. Petersburg, yellow		11	10	12	0
Finlan		9	0	10	0
Memel		10	0	15	0
Gothenburg, yellow		10	0	11	0
,, white		9	0	9	10
Gefle, yellow		10	0	11	10
Soderhamn		9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in.					
,, yellow		21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.		0	14	1	4
Pumice Stone, per ton		5	10	9	0

OILS, &c.

		£	s.	£	s.
Seal, pale	per tun	48	0	0	0
Sperm body		82	0	83	0
Cod		47	10	48	0
Whale, South Sea, pale		48	0	0	0
Olive, Gallipoli		58	0	59	0
Cocoanut, Cochin		53	10	0	0
Palm, fine		38	0	0	0
Linseed		42	0	0	0
Rapeseed, English pale		53	0	0	0
Cottonseed		34	0	44	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
Iron:									
Welsh Bars, in London	per ton	6	10	0	to	6	15	0	2½
Nail Rods	,,	7	7	0	,,	7	10	0	,,
Hoops	,,	8	5	0	,,	8	10	0	,,
Sheets, single	,,	9	5	0	,,	9	10	0	,,
Staffordshire Bars	,,	7	10	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	15	0	,,
Rails	,,	5	10	0	,,	5	15	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	11	0	,,	2	17	6	,,
Swedish Bars	,,	11	5	0	,,	11	10	0	2½
Steel:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	0	0	,,	18	0	0	,,
Copper:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8¼	,,	0	0	8½	,,
Fine Foreign	per ton	94	10	0	,,	95	0	0	3
Tin:									
English Block	pr cwt.	5	19	0	,,	0	0	0	2½
Bar	,,	6	0	0	,,	0	0	0	,,
Refined	,,	6	4	0	,,	0	0	0	,,
Banca	,,	6	9	0	,,	0	0	0	nett
Straits	,,	6	4	6	,,	6	5	6	,,
Tin plates:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	3	0	,,	1	4	0	,,
Lead:									
Pig, English	per ton	20	15	0	,,	23	10	0	2½
Spanish, Soft	,,	20	7	6	,,	20	10	0	,,
Shot, Patent	,,	23	10	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	26	1	0	,,	0	0	0	,,
Spelter:									
On the spot	,,	18	2	6	,,	18	5	0	nett
Zinc:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
Quicksilver	pr btl.	7	0	0	,,	0	0	0	3
Regulus of Antimony:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,

4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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The *Morning Post*, Sept. 29, speaking of Benson's Watches in the Exhibition, says:—"The collection of watches shown by Mr. Benson is a large, and at the same time an interesting one, and considerable attention has been paid by the exhibitor to the decoration of the cases. Many of them are extremely elegant in the design, and were the results of prizes offered by Mr. Benson to the pupils of the South Kensington School of Design." Chronometers, duplex, lever, horizontal, repeaters, centre seconds, keyless, split seconds, and every description of watch, from the plainest to the highest quality of which the art is at present capable, adapted to all climates. Benson's Illustrated Pamphlet on Watches (free by post for two stamps), contains a short history of Watchmaking, with descriptions and prices. It acts as a guide in the purchase of a watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world, to select a watch, and have it sent free and safe by post.—J. W. Benson, Prize Medallist, 33 and 34, Ludgate-hill, London. Established 1749.—[Advt.]

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, APRIL 10, 1863.

UNDERGROUND RAILWAYS.

New inventions seldom spring, Minerva-like, fully armed, prepared to battle their way through the world from the parent brain. More usually they follow the ordinary course of nature, and walk before they can run. Novel schemes, exceptional projects, afford few examples of precocity and, in common with most other matters in this sublunary world of ours, require the finishing touches which old father Time alone can give, ere they can be said to have attained that perfection, necessary to please and ingratiate a public often captious, always critical.

The Metropolitan Railway, unexampled as its success has been, still shows evident traces of that juvenescence common to all new designs; perfect as it is in other respects, it leaves much to be desired in the mode of propulsion; commodious stations, luxurious carriages, civil attendants, an almost perfect immunity from even the chance of accident, locomotion at a fair speed and at a moderate price, are not all the public reqnire. Directors may consider the many-headed monster fastidious, but still he must be satisfied; and there is nothing more sweet to the London public than air, if not fresh, at least wholesome; and the Metropolitan has hitherto proved sadly deficient in supplying the necessary.

The most moderate amount of reflection on the reader's part will convince him of the utter impracticability of getting rid of the products of combustion unavoidably evolved from an ordinary locomotive, in such an effectual way as to permit the atmosphere of this railway to remain pure enough for human use. In consequence engines of very peculiar design, and embracing many novel features of construction, have been hitherto employed to work the traffic. Nearly all the resources of science and talent have been expended on these engines with, we regret to say, very moderate success; and the conviction gradually forces itself on us that, without a further improvement which neither science nor talent at present seem likely to effect, the present mode of propulsion must be abandoned in favour of some other which, perhaps, not so theoretically perfect, will, in practical use, permit the existence of an atmosphere within the tunnel which we can breath freely, unassailed by noxious odours, or tormented by mental associations with the *grotto del cane*, brought on by bodily sensations.

Were the matter to rest where it is, we should not regard it with the same attention as we do when we see that the mighty hand of progress has already laid its iron grasp on the whole subject; already half a dozen Metropolitan—that is, underground—railways are proposed, and join in the favour which the first has received. There appears every likelihood that underground London will be tunnelled and bored by these arteries of communication in every direction; the probability being that few of them will be built with the same attention to ventilation as that now open, or an equal amount of room. The subject of propulsion in such cases becomes of importance to the public at large, and a serious problem for the reflective engineer. When the Liverpool and Manchester Railway was first proposed, this subject met with the greatest attention from the directors, and steam was only adopted after much prudent consideration and careful experiment. With this railway commenced, it is true, a new era of intercommunication on the surface of the earth: with the Metropolitan begins a new era of intercommunication below that surface—an era which certainly presents nearly as many novel points in construction and working detail, for the wise consideration of the engineers of the present day, as ever did the Liverpool and Manchester to their fathers, five-and-thirty years ago.

No mode of propulsion seems to us so likely to suit all the exigencies of such cases as the atmospheric system—a system which we think has been too much "pooh-poohed," and passed over with too much contempt. That it is quite unsuitable for the requirements of an ordinary railway, with the stations at great distances apart and a heavy mixed traffic, every engineer will unhesitatingly admit; but the case is far different with the Metropolitan—a railway of the most moderate length, with the stations close together, and almost exclusively devoted as it is to passenger traffic. For such a line the atmospheric system appears admirably adapted; perfectly safe, providing an admirable means of ventilation, capable of giving the highest speeds ever attained in the annals of locomotion, moderate in cost, and promoting the duration of the permanent way to a degree that those who have not watched its practical operation over a long series of years can scarcely realize. We believe that it only requires a little thoughtful attention to lead to its ultimate adoption.

Many objections can be urged against its use for ordinary railways, objections which we admit to be insurmountable; but only two of these objections will apply to its adoption for such as the Metropolitan—the one, excessive leakage; the other, the difficulty of arresting the train at any particular station. Before referring further to them, we think that a short retrospect of what has been done may not prove uninteresting. In the year 1810, a Mr. Medhurst, a clever London engineer, proposed that mails and passengers should be conveyed in precisely the same way as that now adopted by the Pneumatic Dispatch Company at Battersea; it need hardly be said that at that day his proposal met with total neglect and contempt. We had not yet reached the degree of civilization necessary to satisfy us of the expediency of suffering ourselves to be shot, as it were, through a close-mouthed iron tube! besides which, the cost of the system would be enormous for a long over-ground line. The matter dropped; was revived again by Mr. Pinkus, an American, and finally taken up by Mr. Clegg, who, in conjunction with the late Mr. Samuda, brought the system to a certain amount of practical perfection. They reduced the size of pipe in the manner proposed by Pinkus, and placing it between the rails, placed a piston connected with the train within it, instead of the train itself. The scheme met with such partial favour, that two short lines were laid down on the system—one from London to Croydon, the other from Kingstown to Dalkey, in Ireland; both have been removed, not so much from the failure of the system itself, as many believe, as from the presence of overruling circumstances which compelled the substitution of locomotives. Quite unsuitable as we have already said the atmospheric system is for long railways, each of these short ones found itself swallowed up, as it were, in a few years, by a long one, with hosts of branches and a heavy mixed traffic, so that the original line now forms but a minute fraction where it once formed the whole. It is said that the constant "break downs" of the Croydon stationary engines early brought the system into disfavour then; but that, of course, bore no connection with the merits or demerits of Clegg's design *per se*. The line from Kingstown to Dalkey was worked for many years with perfect success, and a very moderate expense: it was finally absorbed by the Irish South Eastern, which is, of course, worked by locomotives.

As we believe that the principle is pretty well understood, we will not enter deeply into any descriptive details: it is sufficient that we consider the means of overcoming the two objections which we have already alluded to, the first and most important of which is the leakage at the longitudinal valve, and consequent waste of power in pumping; now it must be remembered that, twenty years ago, it was found almost impossible to overcome many difficulties in which the modern engineer sees no difficulties at all; it is only necessary to direct attention to any mechanical want, to find it supplied in a very short time in a manner which leaves very little to be desired. The chief cause of the excessive leakage has been, of course, the imperfection of the longitudinal valve, which, according to the designs of Clegg and Samuda, was made of a long strip of leather rivetted between iron plates; the manufacture of vulcanized india-rubber had not then arrived at any great perfection. Leather, as is well known, soon dries up, hardens, and becomes incapable of making a tight joint, unless it is kept under water or in pumps; in consequence, this valve never answered its purpose very well. We believe that the substitution of some soft preparation of india-rubber instead, would be attended with the best results; Clegg used a hinge-joint. We would suppose that a continuous rope as proposed by Pinkus, say 2 in. thick, made of this soft india-rubber, might easily be so arranged as to run over large grooved pulleys affixed to the piston rod within the tube, in such a way as to gently raise the rope from the groove in the top of the tube, while similar wheels attached to the piston carriage would press it down to its place after the piston had passed; the sides of the groove should be planed to "V" shape, like those in the bed of a planing machine: any of our india-rubber factories would soon supply such a rope, soft, elastic, and unpermeable. Did this plan fail, plenty of others are open for our adoption. It would indeed be a disgrace to our engineering talents if we failed to make such a valve tight enough to fulfil every practical purpose.

The second objection, the difficulty of stoping the train exactly when desired, would be easily overcome on a railway filled with such an efficient system of signals as the Metropolitan—it would be a mere matter of working detail. A suitable valve being fitted at each station, in such a manner that when it was closed all communication with the pumping engine and that part of the tube between the valve and the piston attached to the train would be cut off, it would be only necessary for an attendant, informed by signal of the exact position of the train, to close the valve, when the further progress of the travelling piston would quickly destroy the vacuum before it, and consequently permit the train to be brought to rest; when it was again necessary to proceed, opening the valve would again establish a vacuum, when the train would go on as before. The persons in charge of the pumping engines, acting on the information derived from their pressure gauges, would, of course, slow or stop their engines while the train was at rest. We believe that by such an arrangement the utmost regularity and ease of management—the distinguishing advantage of the locomotive system—could be imparted to the atmospheric.

The question of speed and cost do not present many difficulties. A tube, 3 ft. 6 in. diameter, with pumping engines, &c., could, we believe, be put down for about £600 per mile of single line—a very trifling sum in comparison with the cost per mile of the Metropolitan Railway, and amounting even in the total to a comparatively small sum, as the railway is so short; such a tube, with a 7 lb. vacuum, would give a tractive force sufficient to propel a train of 250 tons at 30 miles an hour on a level, but half that pressure would suffice for ordinary traffic, railway leakage to a minimum. The duration of the permanent way, then, freed from the destructive action of a heavy locomotive, would be more than trebled; we have seen 50 lb. rails which had been in use on the Kingstown and Dalkey line for ten years, under half-hour trains, nearly as perfect as when first put down.

Engineers would do well to consider the matter. We believe that they will find a wide field for their talents: the ground is new and almost untrodden. All this considered, we can scarcely avoid the conclusion that, utterly unsuitable as it is for ordinary railways, no mode of propulsion can be devised more capable of suiting the wants and requirements of Metropolitan railways than the atmospheric system.

REVIEW.

The Working of the Steam Engine explained by the use of the Indicator; *or, an Exposition of the Best Means of producing the Greatest Impulsive Effect from a Given Quantity of Fuel: with a Description of the Mode of Expanding Steam, and the Compounding of Engines.* By Joseph Hopkinson. Illustrated with Engravings and Diagrams. 4th edition, enlarged and improved. London: John Weale, High Holborn. 1863.

Mr. Fairbairn, in his "Useful Information for Engineers," estimated that in 1859 the extent of steam power used in Great Britain was about 11,000,000 horses' power.* The same authority believes that this has increased within the last three years to upwards of 12,000,000 horses' power, in the British Isles alone. The quantity of coal consumed in raising this enormous load of 9,733,214,500 tons one foot high in an hour, he estimates at nearly 25,000 tons, assuming that the average consumption of each of the 11,000,000 horses' power, per hour, is equal to 5 lbs. of coal.

Leaving theoretical problems as to the purely dynamic properties of heat out of the present question, it is well known that engines could be designed and made to work with a consumption of coal, per hour, not much above one quarter of the above amount per horse power. If a man that can make two blades of grass grow where only one grew before, be entitled to the gratitude of his fellow men, how much more must he be recognized as a benefactor who can make a pound of coal give the power of two horses where it formerly only gave one? We would not be supposed as saying that the author of the work we are examining is entitled to national gratitude; his book is deficient and faulty in many ways; but, nevertheless, we consider that it is, in several respects, admirably suited to the comprehensions of unprofessional users of steam power and their engine-men. To such it must be very valuable. We have little hesitation in stating our belief that such persons, of common abilities, after attentively reading this book, ought to be able to get almost as much work out of their engines, with the least expenditure of fuel, as is permissible by the original construction of the apparatus. Those who are acquainted by experience with the often lamentable ignorance of men in charge of steam machinery in the manufacturing districts of England, will forget the want of scientific precision, good taste, and grammatical knowledge of this book on the indicator, and, while only looking to its sterling practical qualities, will hail any means—however otherwise deficient—by which an ordinary engine-man can have some control over the consumption of fuel of his engine, and an unprofessional user of steam power some control over his engine-man. With these excuses, both for Mr. Hopkinson and for ourselves, we will now begin our examination of his book. About fifty pages of this work are given to general elementary directions for the use of the indicator; there are then some thirty pages on most of the different kinds of steam valves, which are followed by a large number, nearly ninety, of indicator diagrams, very well chosen, in order to illustrate the principles of valve-setting. Some observations on working steam expansively and on the compounding of engines then follow. Perhaps the best part of the book is "On the Management of the Steam Engine and Boiler." Lastly, there is a voluminous appendix of tables, "calculated to be of service to engineers."

We find that Mr. Hopkinson, on the title-page of his book, quotes the simile, no less ingenious than true, that "What the stethoscope is to the physician, the indicator is to the skilful engineer—revealing the recent workings of the inner system, and detecting minute derangements in parts obscurely *situate* (sic)." It would have been more graceful in Mr. Hopkinson to have acknowledged the source of the above quotation, because a reader is naturally led to suppose that it is an extract from his own book. The passage quoted, however, is to be found in a small work by Professor T. J. Main and Mr. Thomas Brown.*

Mr. Hopkinson writes "obscurely *situate*"; but this alteration in spelling the adjective without a *d*, does not give him an original claim to this very good motto for a work on the indicator.

The history of the instrument in the opening pages, seems to us to be stated rather incompletely. Mr. Farey, the distinguished engineer and scientific writer, in his evidence before the Select Committee of the House of Commons, formed in 1829, to hear witnesses on the law relative to patents for inventions, gave the following account of the origin of the indicator. Mr. Farey cited this case, amongst others, in order to illustrate the importance of a good patent law in bringing forward and making public inventions that would otherwise be kept secret, and perhaps eventually be lost—"Many years ago, Mr. Watt invented and applied a small instrument, which he called an INDICATOR, to his steam engine; it indicates what extent of plenum and vacuum is alternately formed within the cylinder to impel the piston when the engine is at work. It is of very important use in giving engine-makers true knowledge how to make good engines; and it was of very great use to the inventor, *just as a hydrometer is to a distiller*. He kept it a profound secret for many years; and in 1814, when he published an account of his other inventions, he gave only an imperfect description of a part of this one, without any list of parts which are essential to the successful use. A complete instrument afterwards fell into my hands in Russia, where it had been made by some of the people sent out from this country with Mr. Watt's steam engines. On my return to England, I made one, and also showed several other engineers how to make such for themselves, and, since that time, every one of those persons has very greatly improved his practice by the light it has enabled him to throw upon an obscure part of the operation of steam in an engine. One person who had made an indicator from a sketch that I drew for him, has since printed a description of it in a public journal."

In the chapter on "How to affix and use the Indicator," we are directed (page 14), to mark the atmospheric line *first* and *before* the diagram is taken. Mr. Hopkinson says:—"During these motions the pencil will make a line on the paper round the cylinder. This line is called the atmospheric line. *When that line is well-defined,* open the tap gently, so as to make a connection between the cylinder of the engine and the cylinder of the indicator." Now, in our experience in taking indicator diagrams, we always thought that the atmospheric line should not be taken before the rest of the diagram had been completed. A little reflection will show us to be right; as the heat of the steam will evidently exert an influence on the relative positions of the parts, on the spring itself, &c., and, therefore, on the position of the line which affords the fundamental basis from which the entire result of the diagram is to be calculated. We believe that it is also better to mark the scale of pounds on the paper diagram *before* taking it off the barrel.

The chapter on "Nominal and Indicated Horse-power," is clearly and intelligibly written, as far as it goes; but it is somewhat incomplete, as Mr. Hopkinson gives the rules that are probably only used in his own locality for estimating the horse-power of steam engines. He states (page 32), that the purchaser of a condensing engine should have 22 square inches area of piston, for each "nominal horse power, whatever the speed or pressure." At page 33, it is stated that, "Eleven square inches area of piston is one nominal horse power of a high-pressure engine." Mr. Hopkinson does not say one word about the bewildering number of rules for nominal or commercial horse-power, forming quite an anomaly in steam-engineering. Most of these rules have been collected by Mr. D. K. Clark, in his article "Steam Engine," in the last edition of the "Encyclopædia Britannica," vol. 20, page 602. We will extract the following from this article for the benefit of our readers and of Mr. Hopkinson:—"*Boulton and Watt's Rule* assumes speed of piston to be 128 ft. per minute, multiplied by the cube root of the length of the stroke in feet; and the mean effective pressure to be 7 lb. per square inch. Then, nominal horse-power

$$= \frac{\sqrt[3]{\text{stroke in feet} \times \text{diameter}^2 \text{ in inches}}}{60}$$

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*Steam-engines employed.	Horses' Power.	
	Nominal.	Indicated.
In Mining and Metal Manufactures	450,000	1,350,000
,, Manufactories	1,350,000	4,050,000
,, Steam Navigation	850,000	2,550,000
,, Locomotion	1,000,000	3,000,000
Total	3,650,000	10,950,000

* The Indicator and Dynamometer with their Practical Applications to the Steam Engine. By Thomas J. Main, M.A., F.R.A.S, and Thomas Brown, Chief Engineer, R.N. London: Longman, Brown, and Co., Paternoster-row.

This rule is much in use in the south of England, and to some extent in Manchester.

Manchester Rule.—The common rule is to allow 23 square inches of piston per nominal horse-power, or nominal horse-power

$$= \frac{\text{area of piston in inches.}}{23}$$

Occasionally 30 is used for the divisor.

Leeds Rule.—This rule is taken in terms of circular inches of piston, or the simple square of the diameter, allowing 30 per nominal horse-power; thus, nominal horse-power

$$= \frac{\text{diameter}^2 \text{ in inches.}}{30}$$

This is, practically, almost identical with the Manchester rule, as 30 circular inches are equal to 24 square inches.

For non-condensing engines, the usual rules are as follows:—

Manchester Rule.—Ten square inches of piston are allowed per nominal horse-power; or, nominal horse-power

$$= \frac{\text{area of piston in inches.}}{10}$$

Leeds Rule.—Sixteen circular inches are allowed; thus, nominal horse-power

$$= \frac{\text{diameter}^2 \text{ in inches.}}{16}$$

Glasgow Rule.—Square the diameter of piston in inches, and point off the unit figure. The result is the nominal horse-power. This is the same in form as the Manchester rule, as it is essentially a process of division by 10. The Leeds rule is more liberal than the other, as 16 circular inches are equal to about 13 square inches. For compound engines, having both non-condensing and condensing cylinders, it is the custom in Leeds to throw in the small or non-condensing cylinder, taking no account of it, and to rule from the condensing cylinder only."

Mr. Hopkinson is incorrect in asserting (page 37) that "the merit of the discovery (of the expansion of steam) is due to Hornblower, who, in 1781, obtained a patent for the invention." In 1792 Hornblower applied to Parliament for an Act to prolong the term of his patent of 1781, but the bill was thrown out through the opposition of Messrs. Boulton and Watt, on the plea that Hornblower's engine was a plagiarism of Watt's patent of 1769, extended in 1775 for the term of 25 years from 1775. Watt, in a letter he wrote to Dr. Small, of Birmingham, in 1769, describes the principle of expansion as capable of doubling the effect of the steam. The following is the passage of the letter:—"Open one of the steam-valves, and admit steam until one-fourth of the distance between it and the next valve is filled with steam; shut the valve, the steam will continue to expand, and to pass round the wheel with a diminishing power ending in one-fourth of its first exertion. The sum of this series you will find greater than one-half, though only one-fourth steam was used." Watt used it on an engine at Soho in 1776, and in 1778 he applied it to an engine for raising water at Shadwell. Mr. Hopkinson was probably led into this mistake from the fact of Watt's taking out a patent in 1782, in which the principle of expansion was the main feature, this patent being thus about one year subsequent to the patent of Hornblower. The principle, however, was not completely embodied in Watt's patent of 1769. The discovery of the principle of expansion of steam is said to be another instance of the result of a fortuitous observation made while endeavouring to attain a different object. Watt, wishing to moderate the impulse of the piston of the single acting engine towards the end of the stroke, caused the valves to shut previously to the end of the course of the piston; the realization of increased effect was a result that he had not calculated upon, but which he at once took full advantage of by means of his peculiarly strong powers of observation. By thus setting the catch-pins of his single acting engine, Watt merely wished to obtain somewhat the same effect that we call "cushioning" on a high-pressure engine; arrived at by means of the lead of the slide valve.

It is stated (page 41) that further improvements (in Cornwall pumping engines) have taken place, proving the advantage of high-pressure steam and expansion over that of low-pressure steam and no expansion. It happens, however, that the duty of the Cornwall engines has within late years rather diminished than increased; railways having made the coal cheaper, they do not care so much about wasting it.

We also rather differ with the author in his assertion that great economy has been effected in locomotives by the use of expansion. It is notorious that there is a very large field in that direction still unexplored by railway engineers; and we believe the main reason to be that neither the indicator of Mr. Hopkinson, nor those of Messrs. Macnaught, Gooch, or Bourdon, have been able to take really true diagrams off a locomotive cylinder—we mean diagrams that could be implicitly relied upon.

Mr. Hopkinson appears to us to make rather a cool statement in referring to the use of expansion in marine engines* (page 43):—"Since former editions of this work appeared, marine engineers have begun to act on the principles recommended in the foregoing, and the results have been most satisfactory" (!). We wonder whether, for instance, Mr. Edward Humphreys, of Deptford, regards himself as one of Mr. Hopkinson's pupils in steam engineering.

At page 45 it is stated that the average friction of stationary engines with the shafting is 3 lb. to the square inch of piston. A friction diagram, taken from the top of a condensing engine cylinder is also given at page 45, and the average pressure is 3·5 lb. to the square inch upon the piston. This appears to us be a large average. The size of the engine, &c., is not stated. Small engines have, of course, more friction in proportion than large ones. Again, when the load is on, there will be additional friction; and this friction will be more or less according to the qualities of the oils used for the machinery, &c. In addition to this, the air pump of a condensing engine will have more work when the load is on. These little matters, however, seem to be below the notice of Mr. Hopkinson. This chapter, of three pages, on taking a friction diagram, altogether appears to us to be too short. The book professes to instruct unscientific and unprofessional men, but the author has quite neglected to properly caution an engine-man taking a friction diagram for the first time. It is rather a delicate operation to give an engine steam enough to drive it without its load; an incautious experimenter could very easily break down an engine in this way.

The following is an excellent expression of opinion that is worth quoting, and it is one in which we entirely agree. In describing a well managed cotton mill, he says:—"The engine is indicated every day, and the diagram put into a book for reference; so that, should any alteration take place in the working of the engine or the machinery, or even an increase of friction from bad oil or other causes, it is easily detected. It is found out before it is visible in the amount of fuel wasted; instead of the fuel being lost, the defect is remedied. This is as it ought to be; and were the practice followed up in all cases with the same exactness at the time of starting and stopping the engines, it would be productive of great advantage to owners, and save engineers many a late hour now spent in the examination of engines after the work of others has terminated. It is as necessary for an engineer to have the working interior of his engine laid open before him in a diagram taken every day, as it is for him to see the exterior. Such a practice, if regularly attended to, would save many 'break-downs' and expensive repairs, besides making the mind familiar with the internal working of the engine. Any alterations in the working of his engine would cause the engineer to reason out the various changes that take place from day to day. The advantage would become so apparent that he would continue to make improvements in the management and working of his engine, to economize the fuel and regulate the speed. These important benefits could all be attained with less labour than is entailed by the hap-hazard and guess-work system." By "engineer" Mr. Hopkinson of course means engine-man. It has often struck us as a great anomaly to call an engine-driver an "engineer"—a man who is often not even a workman, much less a man of science and an artist. All three qualifications are required of *an engineer.* He must be an artist, to invent and beautify; a man of science, to correct the conceptions of the artist; and, last of all, a workman, to reduce his designs to practice. It seems to us absurd to call a man requiring so many qualifications by the same name as another who is little removed above the class of a hand labourer.

At page 60, are some excellent practical directions for "lapping the thoroughfares," when the valve chest is too short, and lap cannot be added to the valve. Such passages would go far to redeem a much worse book. At page 64, again, are some sensible observations about agricultural steam engines, which might be useful in some quarters. From what we have seen, we believe that the makers of portable engines, as a class, very much neglect the indicator. The author recommends *his* revolving expansion valve, page 84, for use in locomotives, stating as a reason that the pressure on the back of the ordinary three-port slide valve *is the full boiler pressure throughout the working.* We beg leave to differ from this opinion. There is little doubt that a film of steam interposes itself between the valve face and steam port of a high-pressure cylinder. A practical proof that these valves are *not* weighted with the full pressure due to the area of their backs, is, that numbers of these valves have been working for years without their faces being at all ground away. This could not, of course, happen if they were held down with a pressure, say, of 100lbs. to the square inch.

As an illustration that we were not exaggerating the necessity of either the schoolmaster or the indicator, or rather both, being sent abroad in the manufacturing districts, we will quote the following:—"The *maker* of the Gateshead (on the Tyne) engine prided himself upon the superiority of this engine over others, from the great noise the steam made in the exhaust side. As a proof that it was a good one, several people were called in to hear the good vacuum the engine was making. The noise produced by the exhaust was similar to the noise made by the escaping steam at the top of a locomotive engine chimney!"

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* Expanded steam was used in marine engines as early as 1819, as will be seen in our volume for 1829.

Further on, there is an excellent suggestion to remedy the condenser being made too small and not in proportion to the size of the cylinder :—" When this is the case, the condensing water should be introduced to the steam in the exhaust pipe before it enters the condenser. The water traversing along with steam into the condenser tends to condense the latter quicker and better."

Mr. Hopkinson states (page 108) that "a mistaken opinion exists amongst engineers as to the cause of the irregularity which the diagram exhibits. Many suppose that the irregularity of the figure is caused by the irregularity of action in the indicator, arising from a want of correctness in the working parts, or from the spring of the instrument being too weak." There is no doubt that, in this case, this might have been " the result of the valve (of a low-pressure engine) having too much lead, and of its opening too quickly, so that the rush of the steam struck the piston of the engine with great force in the same way as steam is applied to the steam hammer." But it is also evident that, at high speeds, both the momentum of the steam itself, the momentum of the spring, and of the other reciprocating parts of the ordinary indicator, must influence the diagram of an engine working at a high pressure and speed. The piston of the indicator being thrown up by the momentum of the entering steam so much above the height due to the real pressure of the steam in the cylinder, that the spring thus continues to oscillate during the remainder of the strike, and the result is a jumping, serrated, zigzag diagram. Mr. Hopkinson does not deny the percussive action of steam, as will be seen in the above passage. It will be observed that amongst the very interesting 88 indicators diagrams given by Mr. Hopkinson, only three are taken from high-pressure cylinders, properly so called ; we mean leaving out those taken from the high-pressure cylinders of compound engines. The old remedy for this evil was to make the piston of the indicator somewhat tighter than usual, but this was naturally at the expense of the sensitiveness of the instrument, and of a consequent inaccuracy of the diagram. A small counterspring has, we believe, been sometimes applied.

Another way of diminishing, or even of altogether preventing the vibration of the indicator piston, caused by the percussive action of the steam on the spring driving it up far above the point corresponding to the boiler-pressure, is by throttling the passage of the steam through the cock; the effect produced is also evidently at the expense of the sensitiveness of the indicator and of the consequent accuracy of the diagram. There are other causes besides this that exercise a deleterious influence on the diagram—influences, however, that are not alluded to by Mr. Hopkinson.

At page 165 Mr. Hopkinson says, very truly, that " an engineer, when indicating his engine, to ascertain its real state, should take a double diagram, by which means he will see the slightest difference that may exist in the working, from any unequal admission of steam to the upper and the wider side of the piston." We would go further than this, and assert that when merely the horse-power of an engine is required with any accuracy, a double diagram should always be taken, and the average result would afford the true mean pressure of the steam on the piston. The obliquity of the connecting rod, giving a different diagram for each side of the piston, besides some other influences, are reasons why a double diagram should nearly always be taken.

At pages 108 and 199 Mr. Hopkinson brings certain charges against the McNaught indicator in general, and more especially against the small size of indicator used by the travelling inspectors of the Manchester Boiler Association. We fully agree with Mr. Hopkinson that the larger an indicator the better, other things being equal. There are several reasons, to which we will allude on a future occasion, why a small indicator should be more or less untrustworthy. The original indicators of Boulton and Watt were all of a large size, and were made with a large powerful spring, while the stroke of the piston was much shorter than in the ordinary indicator as made at present. Speaking further about the McNaught indicator, Mr. Hopkinson says :—" This latter description of indicator is not sensitive enough to show the true action of the steam upon the piston of the engine, because the pencil-holder, with the pencil in the position described, acts as a lever with a motion opposed to the motion of the piston, and adds additional friction, preventing a true tracing on the barrel of the indicator." No doubt, under certain circumstances, there is some truth in these strictures. Taking the indicator cylinder as the axis of the diagram barrel, seems also a more mechanical arrangement. The McNaught form, however, is cooler to handle. We have heard, from a source that ought to be reliable, that the late Mr. McNaught, of Glasgow, made several indicators of the form now adopted and manufactured by Mr. Hopkinson. This was in 1826.

The author remarks, page 193, thus :— " Engines for corn mills should traverse at a quicker rate than most other engines, because, where the speed of the work driven—millstones, for example—is great, the speed of the engine should be greater ; if not, there will be what is termed a 'back lash,' and great wear and tear is the result under circumstances of that nature."

We must now notice the peculiar way adopted by Mr. Hopkinson in ascertaining the power of any condensing engine, the steam-line of which expands *below* the atmospheric or datum line. The method he uses does *not* give a really wrong result, when it is wished to ascertain the *gross power* of an engine by means of the indicator ; if, however, it be desired to find *separately* the respective values of the *steam* and *vacuum* pressures, his method is decidedly incorrect. The universal way of ascertaining the mean steam pressure on the piston throughout the stroke, by means of—1st, the steam, and 2nd, the exhaust curve of any indicator diagram, is simply to at once take the mean distance between these two curves. To find the average pressure on the piston throughout the stroke, or to " sum up " the diagram, it is divided at right angles to the atmospheric line in any convenient number of equal parts. The number of pounds between these spaces included between the steam and vacum lines are then measured off by means of the scale belonging to the indicator. The total result is then divided by the number of columns, and the gross average pressure on the piston during the up and down stroke is thus obtained. This is the method used by Mr. Hopkinson for his high-pressure engine curves ; it is also the method that is always adopted by the steam department of the Admiralty and the principal firms in the kingdom ; the little book sent out by Mr. McNaught with his indicators also advocates no other plan.*

In dealing, however, with the diagrams of condensing engines, Mr. Hopkinson adopts a peculiar method. Instead of *at once* measuring right across the diagram, he separately measures the ordinates of the steam and vacuum curves, from the atmospheric line as a basis. The evident result of this plan is, that if he merely wishes to obtain the *gross* pressure on the piston throughout the stroke, he does this at the expense of double work. If he wishes to find, *separately*, the *exact value* to be given to the steam and vacuum pressures, he obtains an inaccurate result. It will be at once seen, on reflection, that we are right. In any properly constructed condensing engine, the steam line of the diagram expands *below* the atmospheric line. At the beginning of the stroke it is *above* the line, and further on it runs *below* the atmospheric line. In adding up the steam pressures, Mr. Hopkinson only notices the *plus* pressures *above* the atmospheric line, while he neglects the *minus* steam pressures *below* the atmospheric line. In adding up the vacuum pressures, instead of taking the complete vacuum up to the atmospheric line, he measures the ordinates between the steam line (that happen to be below the atmospheric line) and the vacuum or exhaust line. It will be at once perceived that the steam pressure is exaggerated by only taking the *plus* pressures into account, while the vacuum pressures are detracted from by not measuring them up to the atmospheric line. The *total* amount comes *right* at last ; but the *separate* values of the steam and vacuum pressures are *wrong*. Mr. Hopkinson says, in the preface, page iv. :—"Although the mere theorist or scientific literary writer may object to the plain and simple manner in which the different topics descanted on is (*sic*) treated, the author is assured, from the difficulties which in the early periods of his experience he himself had to contend with and overcome, that his plan of procedure is the best that he could possibly have adopted for the accomplishment of his main object in undertaking the work—the instruction of the practical *working* engineer." We suppose Mr. Hopkinson will put us down as " mere theorists " for making these objections. However that may be, we look upon this book as a very valuable work in many respects, and we should be only too happy to receive any valid excuse. But it happens that there is a simple plan by which the most ignorant fireman, totally unconscious of the deep mysteries of *plus* and *minus*, can take the separate values of the steam and vacuum pressures, of an indicator diagram. It is one often employed in the steam department of the Admiralty. The atmospheric line is taken as equal to 15 lb. ; and from this line, as a point of departure, fifteen other lines are marked by the scale, thus coming below the vacuum line of the engine up to the true vacuum line of a perfect exhaust. The *lowest line* is then taken as the *zero* or *datum* line, and the *actual* pressures (not the relative pressures as compared with the atmosphere) of both the steam and vacuum lines can thus be obtained. The difference between these two pressures gives the gross or actual pressure on the piston.

To engineers, *not* enginemen, having often to calculate the actual horse-power of steam engines from indicator diagrams, we would recommend the use of a very handy book of tables of logarithms compiled for this purpose by Mr. James Overend.* It is simply a compilation of four logarithmic tables—the first giving the logarithms of the areas of cylinders from a diameter of 25 in. to 99¾ in. ; the second contains the logarithms of the pressure per square inch on the piston from 10lb. to 91lb., and of the revolutions per minute from 10 to 91 ; and the third, the revolutions per 24 hours corresponding to these revolutions per minute. The fourth table is one of the common logarithms of numbers from 1 to 1,500. These tables must be delightfully convenient to a marine engineer having to calculate a diagram under the burning sun of the tropics, superadded, perhaps, to the heat of the engine room. It is evident that there must be a saving of, at least, three-fourths of the present amount of labour.

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* Description and Use of McNaught's Improved Indicator ; or, Dynamometer for Steam Engines. Glasgow : printed by James F. Hay, (Sydney Court), 62, Argyle-street. 1860.

* Tables for Calculating the Power of Steam Engines, from the Diagrams furnished by McNaught's Indicator. By James Overend. London : Waterlow and Sons.

We will resume our notice of Mr. Hopkinson's book in a future number.

INSTITUTION OF CIVIL EMGINEERS.

At the meeting of the Institution, on March 31, 1863—John Fowler, Esq., Vice-President, in the chair—the Paper read was on "Structures in the Sea, without Coffer Dams; with a Description of the Works of the new Albert Harbours at Greenock," by Mr. D. Miller.

It was stated that the immediate object of this Paper was to treat of the various methods of constructing the foundations of quays, walls, piers, or breakwaters, for the formation of docks and harbours in deep water; and to describe works of this kind which had been carried out on principles different to those usually practised, and to point out the further application of those principles to other structures of a similar nature.

The plans which had chiefly prevailed were, founding on piling carried up to about the level of low water, constructing within caissons or coffer dams, or building under water by means of diving apparatus. Instances of the failure of the first of these methods, which was believed to be inapplicable where there were marine worms, were given. The second was most effectual, but was generally expensive, and often attended with danger. The last was also costly, besides being subject to delay in the progress of the works. In bridge building, of late years, the plan of forming enclosures of close piling of the shape of the pier, and filling in with hydraulic concrete, had been pursued by French engineers; and the substitution of iron for perishable timber piling, in the construction on this plan of the piers of the Chelsea and Westminster bridges, by Mr. Page (M.Inst.C.E.), was considered to be a successful departure from stereotyped rules.

Although the value of béton or hydraulic concrete was now appreciated in this country as a substitute for masonry, and had been employed in some important works; yet its use was chiefly confined to forming a homogeneous and monolithic bearing stratum for foundations, and not, properly speaking, as a constructive material. The modes in which concrete had been applied for constructive purposes—were building it dry in a mass, and allowing it to set before being placed in the work, as had been adopted in the construction of the walls of the Victoria and of the London Docks; preparing it first in blocks, and allowing it to harden before being used, as employed at the Dover Breakwater, and for the new sea forts at Portsmouth and Plymouth; and depositing it in a liquid state, and allowing it to set under water, as practised at the Government Graving Docks at Toulon. The facilities for making béton which had the invaluable property of setting under water, and of thus forming an artificial rock or stone, were very great; as it might be made either from the naturally hydraulic lines, the artificially hydraulic lines, or cement, or from rich or non-hydraulic lines, rendered hydraulic by the admixture of other substances such as Puzzolana, minion, or iron mine-dust. Various examples were adduced of the application of concrete, on a large scale, prepared from these different materials, especially at the Mole of Algiers, at the breakwater at Marseilles, and at other French ports, as well as in the Pont d'Alma over the Seine, in which case both the arches and the piers were formed of rubble concrete.

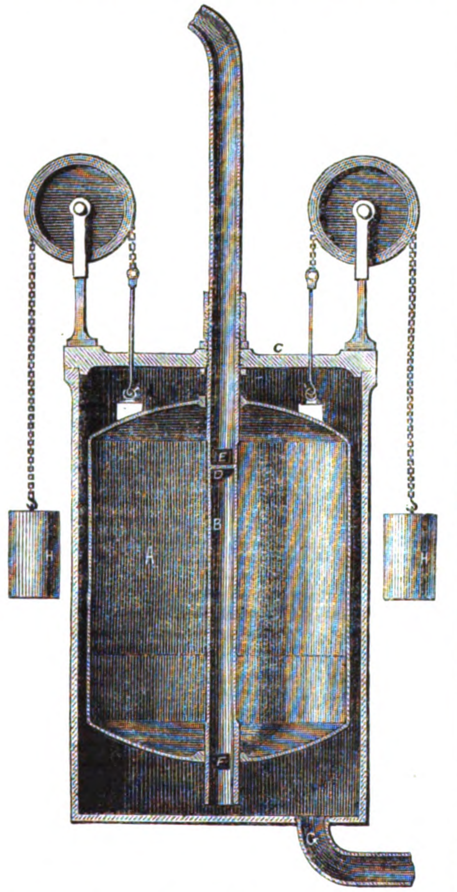
As Engineers-in-chief for the new harbour works for the port of Greenock, the author and his partner, Mr. Bell, had an opportunity of introducing a system of constructing sea walls and quays in deep water, without the aid of copper dams, diving apparatus, or other means equally expensive. These works were situated on the west side of the town, and had been projected almost entirely beyond the high-water line into the sea. The outer pier would ultimately be upwards of 3,000 ft. in length and 60 ft. wide at top, with quays on both sides. Within this there would be space for two harbours, each 1,000 ft. in length, 15 ft. deep at low water, and 25 ft. at high water, with entrances 100 ft. wide, and ample room for the construction of graving docks, for the storing of timber, and for the erection of sheds. At present it was only proposed to erect about one-half of the sea pier, and to form one harbour or tidal dock. In the design of these works, it was suggested that the walls, under low water should consist of a combination of cast-iron guide piles in the front, with a continuous stone facing, slid down over and enclosing these piles, timber-bearing piles being used in the body of the walls where reqnired, and concrete backing being deposited in a soft state; and that the upper part of the walls should be built of masonry in the usual manner. The first operation, when the water was not sufficiently deep, was to dredge two parallel trenches to the required depth, 17 ft. below low water, for the foundations. A staging of timber piles was afterwards erected in the line of the pier over its whole breadth, or carrying the tramways, travelling cranes, and piling engines. The cast-iron guide piles were then driven from the staging, with great precision, 7 ft. apart in the line of the face of each quay wall. These piles were driven until their heads were near to the low water line, by pile engines furnished with long arms projecting downwards, strongly stayed by diagonals, and forming a trough into which the pile was placed, and from which it was shot, like an arrow from a cross-bow. The piles were connected at the top transversely by wrought-iron tie-rods stretching through the pier. When the piling was driven, a bed of hydraulic concrete, 3 ft. thick, and 20 ft. wide, was deposited in the trenches to form a base for the wall, and to give a large bearing surface. Into the grooves formed by the flanges of the iron piles, large granite slabs, from the Ross of Mull, from 18 in. to 2 ft. thick, were slipped, the bottom one resting on the concrete base, and on a projecting web cast on the piles. This constituted the face of the wall, and in each compartment betwween the piles, 16 ft. in height and 7 ft. in width, there were only three stones. Behind this facing hydraulic concrete was lowered under low water in large boxes having moveable bottoms, and was discharged in mass to form the body of the wall. To confine this at the back before it had set, loose rubble stones were deposited. The hearting of the pier consisted of hard till, stones, and granite, up to the level of low water. When the whole of this mass was consolidated, the heads of the iron piles and the granite facing blocks were capped by a granite blocking or string-course, and the upper portion of the walls was built in freestone, ashlar, and rubble. The remainder of the hearting between the walls was then filled in, and the whole finished with a granite coping and causeway. The walls were 33 ft. in height from the foundations, 11½ ft. thick at the concrete base, diminished to 5 ft. at the top. In the part of the work already executed, the outer flange of the iron piles was exposed to the action of the salt water. In future it was intended to reverse this plan, and to make grooves in the stone facing, so that it should overlap the iron piles, filling in the groves from the top with cement. When the whole extent of the seaward pier was completed, the interior operations for the harbour would be proceeded with; this pier serving as the principal coffer dam, and a short dam, about 100 ft. in length, closing the entrance. It was stated that this mode of constructing walls in deep water without coffer dams had been most successful, and that a sea-pier of great solidity and durability had been formed in deep water at a comparatively moderate cost. The works of the Albert Harbour were being executed under the superintendence of Mr. John Thomson, as Resident Engineer, by Messrs. W. and J. York, contractors.

The application of this system to the construction of breakwaters and harbours of refuge, was then noticed, reference being first made to the principal modes of construction hitherto adopted, and to the peculiar phenomena by which such structures were affected. The usual method of forming breakwaters was by the "pierre perdue," or long-slope system, as carried out at Plymouth, Cherbourg, and Holyhead. Where stone was not abundant, a vertical wall was built from the bottom by means of diving apparatus, of which the breakwater at Dover, now in course of construction, was the most prominent example. Besides these systems, which might be taken as the extremes, an intermediate form of section, combining both, that was to say, a rubble mound to a certain depth under low water, and a vertical wall above, had been carried out at Alderney. From an examination of the general principles which affected breakwaters, and the modes of construction usually adopted, the conclusion arrived at was, that the vertical system was that which best resisted, or rather averted, the destructive action of the sea, and required the smallest amount of material. Both the long-slope and the vertical systems, as at present carried out, were expensive, from the quantity of material used in the one case, and the costliness of the material and the mode of construction in the other. The former might be characterized as involving the maximum in quantity, and the minimum in cost of material; the latter, on the contrary, the minimum in quantity, and the maximum in cost of material. The object sought to be attained in the new system was to effect a minimum, as far as possible, both in the quantity and in the cost of the material. Breakwaters might be thus constructed, either wholly vertical from the bottom, or partially vertical, springing from a rubble mound. The principal feature of the new plan was a framework of iron piles, or standards, and ties, which would serve during the construction as the staging, and would afterwards form an essential portion of the structure, by binding together a strong casing of stone, or other sufficiently durable material, which would enclose and form the facing of the breakwater, the interior being filled up with loose rubble, cemented into a solid mass by liquid concrete. As soon as a pair of piles transversely had been fixed, rubble would be deposited up to, say, 18 ft. under low water. Strong casing blocks, either of stone or of béton, made to enclose the iron standards, would then be lowered, the blocks being locked or arched into each other, so as to resist pressure from behind, and made to break bond, if thought desirable. The hearting of the work would be proceeded with simultaneously with the building of the casing, and would consist of rubble in the centre, and of hydraulic concrete behind the stone casing. It was believed that such a structure could be erected in a depth of 6 fathoms, with a range of tide of 15 ft., for £190 per lineal yard without a parapet, and at £200 per lineal yard including a parapet. The economy of this system would arise from the smallness in quantity and the cheapness of the bulk of the material. It would also possess the advantage of rapid execution, as the mass of the material could be deposited without any tedious operation being necessary, over a great length of the work at one time.

The author was of opinion that the system which had been described admitted of being applied for the construction of the works under low-water of marine fortifications, as well as of breakwaters, piers, quay-walls, lighthouses, and other similar structures. He considered that, although the mode of constructing any engineering work must be determined greatly by local circumstances, the system presented the following advantages—great economy, combined with strength and durability; facility and rapidity of execution; and adaptability to situations where the present modes of construction would be inapplicable.

STEAM TRAPS.

The following is a description of a steam trap, the invention of Mr. E. A. Pontifex, of Shoe-lane, London. This kind of apparatus for facilitating the escape of condensed steam, is applicable to any kind of steam machinery from which it may be desirable to draw off or remove water produced by the condensation of the steam. Instead of trapping the steam by means of a valve attached to a float as is now usually the case, and which float is exceedingly liable to stick and get out of order, the steam and water are allowed to enter a reciprocating rocking or moveable vessel or chamber which is properly balanced and is provided with valves or openings which are opened and closed as the vessel rises and falls. When the balanced vessel has received a given weight of water from the condensation of the steam, it will be carried down by its weight, and in so doing will uncover or open a valve at the bottom of the vessel, and allow the water to run out. The vessel thereby lightened will then be raised up again by the counterbalance weights to its original position, and will close the exit openings or valves until more water or condensed steam accumulates in the vessel, when the latter will descend again and allow the water to run out.



A variety of mechanical arrangements may be devised for effecting the object of the invention, but they will all be constructed on the principle of causing the weight of the water or condensed steam in the suspended or balanced vessel to overcome the counterbalance weight, and by carrying down the vessel to open or uncover a valve or valves or exit passages. For instance, the vessel may be suspended vertically by chains or cords passed over pulleys and counterbalanced by suitable weights attached to the other end of the chains.

In the accompanying drawing is shown one view of the arrangement of this apparatus. A is the balanced vessel, which is bored out truly so as to form a moderately steam-tight joint, and to enable the vessel or box A to slide with facility up and down on the inlet pipe B, which is screwed or otherwise rigidly secured to the plate C. This pipe B is stopped at D, and has outlet passages E, E, opposite each other so as to neutralize the friction, and to admit the water and steam into the balanced vessel A, which is free to slide on the pipe, B. F, F, are outlet ports or passages made opposite to each other near the lower end of the pipe B. G is a waste pipe for emptying the casing which encloses the balanced vessel A. H, H, are balance weights hooked on to the ends of the chains I, which pass over the pulleys J, J, and support the vessel A. The water and steam enter the apparatus down the pipe B, and pass through the ports E, E, into the balanced vessel A. As the water accumulates therein, its weight counterbalances the weights H, and ultimately overcomes them and causes the vessel to slide down the pipe B, and allow the contents of the balanced vessel A to have access to the outlet passages F, through which the water escapes from the vessel A and runs off by the waste-pipe G.

Another form of apparatus and mode of arranging the condensed steam-box A, is to balance this latter horizontally on a fixed hollow axis, through one end of which the water and steam are allowed to enter. When the equilibrium on the weight of the parts is destroyed, the condensed steam-box will oscillate on the hollow axis, and the water or condensed steam will pass out through an opening which the oscillation of the vessel will have uncovered on the other end of the axis.

MACHINERY BELTING.

Mr. M. T. Haines, who has already patented several plans for bands and straps, has lately patented additional improvements in the manufacture of driving bands or straps. In the

FIG. 1.

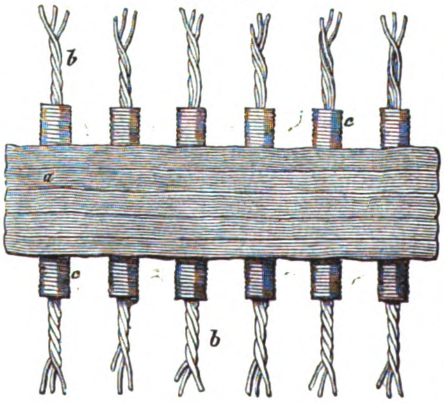
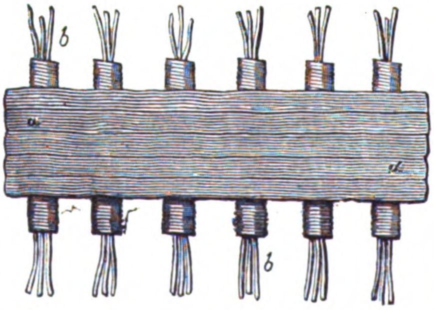


FIG. 2.



Specification of an Invention for which Provisional Protectional was granted to him on the 28th August, 1860 (No. 2078), was described the manufacturing driving straps of short strips of leather, hide, or other suitable material, cut to a width equal to the thickness and to a length equal to the width of the intended strap. The strips had holes formed through them, and were threaded side by side on lengths of wire rope, the wire rope thus running longitudinally of the strap. Now, according to the present invention, the lengths of wire are bound round rope with a helical coil of wire in such manner that the coils lie close up to one another before threading the strips of hide or other material upon them, or in place of employing wire rope thus bound round with wire, straight lengths of wire bound round with a helical coil of wire may be employed. Fig. 1 of the drawings hereunto annexed shows a driving strap composed of short strips *a*, *a*, of leather, cut to a length equal to its thickness the strips; have holes formed through them in order that they may be threaded on the lengths of wire rope *b*, which run lengthwise of the strap, each length of wire rope being bound round with a helical coil of wire *c*, as is shown, the wire and wire rope are both preferred to be of iron, but they may be of other metal. Fig. 2 shows a strap composed of short strips of leather *a*,*a*, threaded on straight lengths of wire *b* bound round with a helical coil, three lengths of wire being bound together by each coil, but this may be varied. According to this invention, driving straps are also formed by threading short strips of leather, or other material cut as above described, upon cords composed of raw hide cut into long thin strips; the strips are softened by soaking in water and are then twisted together into a cord, the cord may then be drawn through a circular die to render it smooth and even, or the short strips of leather may be threaded on cords composed of lengths of thin strips of raw hide and lengths of wire twisted together.

WATER VALVES.

The following is a description of a new kind of pump valve for large mining pumps. It is the invention of Mr. William Husband, of Hayle, Cornwall, and the object of the construction of this valve and seat is to obtain greater water or steam way than has hitherto been attained with the same lift of the valve off the seat, consequently to diminish the shock both in closing and opening the valve, and at the same time give greater freedom for the passage of liquid or fluid. It is also of almost equal importance that the weight of this valve may, in consequence of the reduced lift, be considerably diminished with a proportionate diminution of the motive power employed, and thereby, in steam engines, economizing fuel. On the seat of the valve box or nozzle is to be bolted an annular iron bed plate, having eight or other number of arms or supports extending obliquely upwards and inwards therefrom, for the purpose of sustaining an uppermost and an intermediate similar annular bed plate of the same diameter, or decreasing in diameter, according as the vertical section of the supporting arms to this point is parallel or decreasing in diameter. The bottom and top bed plates are each furnished with a ring of composition metal, wood, india-rubber, or other material, let into a channel cut around their surfaces, the surface of the rings being slightly raised above that of the plates. The central or intermediate annular plate has two of these gun metal or other rings let into its surface; namely, one at the upper and the other at the lower part thereof. There will thus be four rings of metal or other material in the seat, each of which serves for the bearing surface of corresponding rings of iron, which are formed by the lower surfaces of two dome-shaped caps or covers connected together by eight or other number of arms. The uppermost bed plate supports vertical gun metal bearings for the inner circumference of the upper dome, and to the lower part of the arms of the bed plate similar bearings are bolted in order that the connecting domes may be kept in a level or horizontal position during their rise and fall. The moveable portion of the valve is prevented from rising beyond a necessary height by means of a projecting flange at the top of the upper bearing surface, and a ring of vulcanized india-rubber or other material under the flange will obviate any shock or jar to the valve caused by the alternate ascent of the domes. Fig. 1 is a vertical section through the centre of the valve and seat; and fig. 2 is a plan view showing half the seat. A, A, represent the arms which unite the various valves B, B, which close on the seats C, C; the pressure of the water raising the valves from their seats and allowing it to flow towards the pump or the main as they may be used for suction or discharge. It will be observed that the arms A are cast or formed to unite the valves, inclined from a vertical plane, in such manner that the valve, when rising by the action of the water, will rotate, thereby ensuring an equal or level wearing of the beats and guides. It is preferred to give the upper part of the valve A the greatest proportional lifting area, in order to keep the centre of gravity of the valve low down and to prevent any tendency to cant to one side. This arrangement of areas is (according to the patentee) not always advisable, but in some cases may be modified, according as circumstances may require. The construction of the valve may be varied without departing from the principle of this invention by making it on the internal plan, that is to say, by making the seating approximate the form of a hollow cone and dropping the valve into it.

Fig I

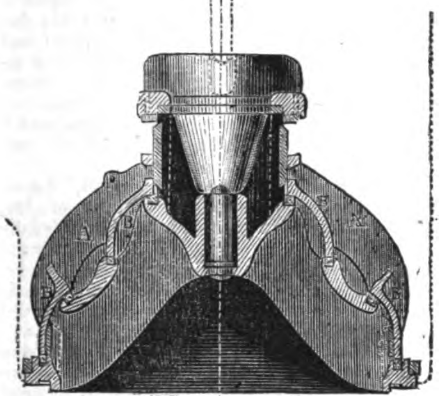
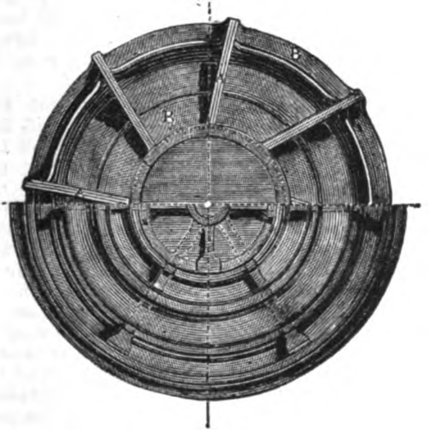


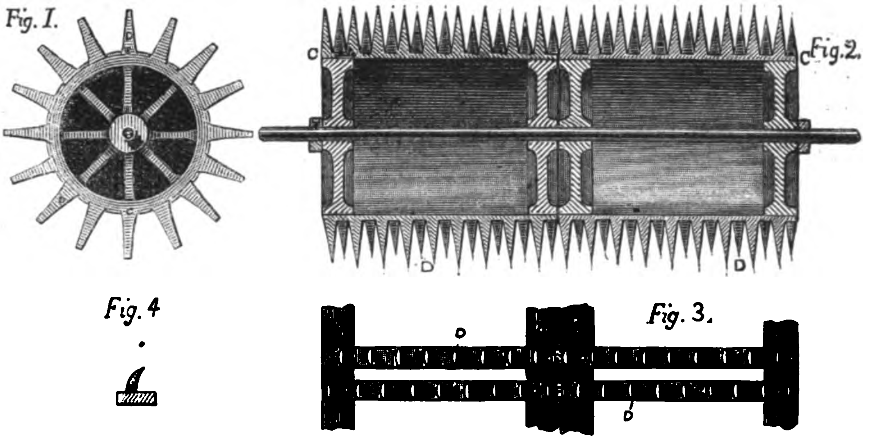
Fig 2.



CLOD CRUSHERS.

Messrs. Joseph and Benjamin Harrison, of Otley, Yorkshire, have lately patented a description of clod crusher, which consists of two, three, four, or more drums, wheels, or discs, placed at intervals on a shaft, and a series of bars or lags with spikes cast or fixed on one side thereof, and which bars are fixed at small distances apart, or leaving spaces betwixt them across the edges of the drums with the spikes outward, thereby constituting a spiked skeleton roller or clod crusher. The bars are formed to fit into dovetail notches in the drums or discs, and arranged so that the spikes on one bar shall be intermediate to those on the adjoining bars in the line or direction of rotation.

MESSRS. HARRISONS' CLOD CRUSHERS



In the accompanying engravings, fig. 1 is an end view, and fig. 2 is a longitudinal section of the spiked roller or improved clod crusher.

The parts marked with the letter A are four cast-iron drums or wheels mounted on a wrought-iron shaft The rims of the drums have dovetailed notches or recesses formed so that the lags or bars C fit and are retained therein by the aid of a small bolt or pin *a*, passed through the lag and rim at each jointing. D are the spikes, which in this illustration are cast with the bars, but may be cast separate and fixed to wrought-iron bars, by having bolts or pins cast therein, or they may be cast on to the wrought-iron bars by having suitable holes first made in the bars, and the bars placed in the mould when casting the spikes, or both spikes and bars may be of wrought iron and rivetted or screwed together. The spikes are so placed on the bars, or the bars so arranged when fixed on the drums, that the spikes are intermediate to each other, as shown at fig. 3. Fig. 4 is a side view of a picker or spiked bar, to be applied to the clod crusher for picking out or removing from betwixt the spikes any clods, stones, weed, or other substance which may stick therein during the working or using of the same. It must now be understood that this roller or clod crusher is to be mounted or provided with suitable framing for removing it, such as in ordinary use with rollers or clod crushers, but which forms no part of this invention, and being well known it has not been thought necessary to describe or show by engravings.

It will be seen that the roller here shown is in two parts in length, thus forming two rollers on one shaft, both of which run loose, so as to give ease in turning at the ' headlands," or where required; and it will be evident they may be made in three or more parts if desirable, or in one length only, and either loose on or fixed to the shaft. For the moving of this roller on roads from field to field, and where the spikes are not required to operate on the ground, a pair of plain portable wheels of larger diameter than the spiked roller are applied or placed one on each end of the shaft, by which the roller is supported and the points of the spikes are kept clear of the ground.

THE STEERING OF LARGE SHIPS.

At the last general meeting of the Institute of Naval Architects, Mr. Nathaniel Barnaby read an able Paper " On the Steering of Ships, particularly large Ships-of-War." The following is an abstract of the Paper :—

Within the last twelve months the idea of employing the momentum of a ship of war as a means of injuring the enemy has gained ground, and nearly all the war-ships in course of construction in England and France have such a form of stem, and such increased strength of bow, as will allow them to be used as rams should the opportunity occur. The "Resistance" and "Defence," for example, have been shorn of those graceful appendages, the figure-head and knee, the stem has been made to fall back at the head, the bow has been built with extraordinary strength, and various other measures have been taken to make it possible to employ these ships in such a service. But it would be idle to suppose that they would able to avail themselves of the vast power of attack possessed by them in this respect with their present steerage power.

Let us see how the matter stands. Under favourable circumstances, the "Resistance" can turn completely round in six minutes and a half; but in doing this at full speed—*i.e.*, when the time of turning is shortest—she describes a circle 1,800 ft. in diameter. The rudder will not turn her without steerage way, and that steerage way involves the awkward consequence, that if the officer in command wishes to turn the ship at full speed through an angle of 90 deg. in order to bring his stem to bear upon an adversary with which he had just exchanged broadsides, he would find himself, at the completion of the operation, a quarter of a mile from the place where he commenced it. I do not take this ship in order to exaggerate the difficulty, but because she has been remarkably successful, and is the perfection of our present system of steering. The "Warrior" and "Black Prince" afford a still more striking illustration, because of their great weight and length.

In the former ship the time occupied in turning completely round at five different trials varied between 7 min. 46 sec. and 9 min. 5 sec., and averaged 8 min. 20 sec. In the "Black Prince," the time at six different trials varied between 8 min. 3 sec. and 13 min. 33 sec., and averege 10 min. and 22 sec. The space traversed by them in turning is so great that in passing through 90 deg., under the circumstances before mentioned, the vessel would have to travel nearly half a mile.

In these ships also the ordinary means of steering are as perfect as they can be made. In the "Black Prince" especially, no pains have been spared to perfect the steering gear; and as some naval officers were of opinion that the rudder was too small, its area has been increased from 151 to 178 square feet. But the "Warrior," which has not been altered, remains superior to her. We cannot suppose that any vessel which was not completely helpless would suffer herself to be run into by such ships.

What are we doing to remedy this undesirable condition of things? One cannot deny that there has been considerable activity of invention with regard to steering; but there seems to be much misapprehension on the part of inventors as to what we really need. An inspection of the models representing improvements in steering which were sent to the International Exhibition last year, was sufficient to show this.

The majority of them related to improvements in the mode of applying manual power to the ordinary rudder; although the advocates of auxiliary rudders, bow rudders, and balanced rudders were not unrepresented; and there were prominent models of double or steering propellers.

Nothing whatever is to be hoped from this first and most numerous class. The only real difficulty to be contended with inside the ship is friction. Neglecting this, no possible alteration in wheel, or tiller, or yoke can reduce the labour of the men, without increasing the time occupied in putting the rudder over. Nor, on the other hand, can this time be diminished without increasing the labour of the men.

We already know how to reduce this friction to a small amount, and should gain very little if we could get rid of it altogether. Inventors in this direction are more likely to excite ridicule than to achieve success.

There are inventions, it is true, for performing the work of turning the rudder by hydraulic or steam power; but supposing such apparatus can be perfected, the condition of things already pointed out in the "Warrior," "Black Prince," "Resistance," and other iron-cased ships as to the time occupied, will in all probability remain. We must therefore look for improvement in the instrument which acts directly upon the water.

And first with regard to the size and shape of the ordinary rudder.

Some gentlemen have very strong opinions on this matter. One eminent shipbuilding firm considers that the lower part of the rudder is of little service, and their rudders are accordingly made *lean* at the bottom. Others are of opinion that no rudder can be good unless it is very *broad* at the bottom; and there are some staunch advocates of a great breadth at the height of the centre of pressure. And then as to size, it has been asserted by eminent naval officers that the rudders of modern men-of-war are too small, and that the sluggishness of the "Warrior" in answering her helm is due to this cause.

Now the first point which has to be considered in regard to these matters is this:—Is the rudder large enough to absorb all the power we can put on it? If we find, as we do find in nearly all our screw-ships, that the men at the wheel cannot hold the rudder at the extreme angle for which it is bearded, but have to exert all their force when the vessel is at full speed in order to hold the helm at 15 or 16 degrees, then we may be sure that the area of the rudder does not require to be increased. There are, in fact, certain considerations which show that, as a general rule, our rudders are *too large*. It will be seen, first, that the further the rudder is put over, the greater is the velocity of the fluid in a direction perpendicular to its surface, or the effective velocity of the fluid. There is therefore an *advantage, so far as increase of pressure is concerned*, in working with a large angle or with a small rudder.

But, on the other hand, the effect of the pressure on the rudder in turning the ship depends on the leverage or on the amount of the pressure about the centre of gravity of the ship, which is in proportion to the length of the perpendicular drawn from the centre of gravity, upon the direction of the resultual pressure. The length of this line diminishes as the angle increases, so that, *so far as this leverage is concerned*, there is a *disadvantage* in large angles and small rudders. A third consideration, pointing to the same conclusion as the second, is, that large angles or small rudders require more time in putting the rudder over, so that the vessel would not answer her helm so readily with a small rudder as with a large one.

And then there is a fourth consideration, to which my attention has been recently directed by Mr. Barnes, of the Department of the Controller of the Navy—viz., that while the outer half of the ordinary rudder does no more in turning the ship than the inner half, it absorbs three times the amount of labour, on account of its distance from the fulcrum. This is another advantage on the side of the small rudder, and one of considerable consequence. He concludes from it that rudders which cannot be worked at large angles, are unecomical, and should be reduced in area until they can be so worked.

If a problem of maxima and minima be constructed, expressive only of the first two conditions laid down here, it appears that the rudder would be most effective in turning the ship if it were over at an angle of 54¾ deg.

But, if the fourth or economical consideration is also brought in as one of the conditions of the problem, so as to discover with what angle and breadth of rudder *a given power* on the wheel may operate most effectively on the ship, the angle comes out 45 deg., and of course the breadth of rudder such that the former will just maintain that angle. Although this undoubtedly shows that rudders which can only be worked at 15 deg. or 16 deg. are too large, I am afraid the necessities of a ship which must be sometimes under sail and sometimes under steam will limit improvement in the ordinary rudder in this respect; for a rudder which could be held hard over when under steam, would certainly be too small when under sail.

Mr. Barnaby then described Mr. Lumley's rudder, and showed that the success obtained with it was very partial, and scarcely affected at all the time occupied in turning. He then proceeded to consider the balanced rudder, in which the rudder surface and the steering power may be increased without acquiring any increase in power applied.

This idea is so promising that it has been often patented. As long ago as 1790 a patent was granted to Charles Earl Stanhope for this invention, called by him an equi-pollent rudder. It has been adopted also in some of Mr. Scott Russell's ships, and I believe in others; but, so far as I can learn, these rudders in screw-vessels have always been placed *before* the screw.

In the recent experiment to which I refer, made by Capt. Key, R.N., this rudder was fitted in a temporary manner *abaft* the screw, and the following facts were established:—

1. With a very small exertion of power, the rudder may be put over to any angle when the vessel is at full speed.

2. That in order to obtain the necessary balance for this purpose, with these relative positions of rudder and screw, the after part of the rudder must be *twice* as large as the fore part.

3. That whereas the ordinary rudder can only be got over to 15 or 16 deg. when the ship is at full speed, and that with great effort, this rudder could be held with ease at angles up to 45 deg., and that by thus increasing the angles, both the diameter of the circle and the time of turning were slightly diminished.

4. It was found that an *increase* in the *area* of the rudder, while it reduced the diameter of the circle described and also the time of describing the first quadrant of the circle, increased the whole time of describing the circle. It was found, further, that, other things remaining the same, an *increase* in the *speed* of the vessel shortened the time of describing the circle, while it *increased* the *diameter of the circle* described.

It has been stated above, that the advantage over the ordinary rudder, with regard to quickness of turning and turning space required, was *slight*. This was probably owing, to some extent, to the fact that the balanced rudder was further from the screw than the ordinary rudder, and therefore did not receive so much assistance from its action upon the water. It is not, however in gunboats, but in ships 300 and 400 ft. long, that the advantages promised by the balanced rudder are wanted. We are told, for example, that the "Black Prince" was, on one occasion, turned completely round in 8 min. 3 sec., the rudder being over to 28 deg.; but, in order to hold it there it required 10 men at the wheel and 30 men at relieving tackles—no less than 40 men being employed at this operation. This is, of course, an extreme case; but it serves to show that an invention which promises to reduce these to one or two men, has great claims to consideration. An advantage which is of slight consequence in small vessels, assumes in these large vessels very great importance.

But, suppose we consider it proved that the balanced rudder would give the advantages we desire, where is it to be placed? We are told that it must not be before the screw, for in that position it has been found to fail. If placed abaft the sternpost, it is subject to the disadvantage of being too far from the propeller, of suffering from the obstruction interposed by the sternpost, of liability to jam by confining loose ropes or other partially sunken matter between the fore edge of the rudder and the back of the post; and, lastly, it requires too great an extension of the stern of the ship. The question to be considered is, I think, this—May we not in our large iron ships get rid of the sternpost altogether, and fit the balanced rudder in its place abaft the propeller?

In the case of the "Northumberland," for example, the after sternpost is a mass of iron weighing 9 or 10 tons. Its only conceiveable uses in this ship are to support the rudder and hold up the stern.

I should not have troubled you to consider the latter of these two uses, if I had not heard it strongly insisted upon by some shipbuilders. I must confess myself at a loss to conceive of what service it can be in this respect. If there were any tendency in the stern of the ship to settle down can it be supposed that the long and comparatively thin forging, extending from the bottom of this post to the body of the ship, would be so rigid as to refuse to bend two or three inches in 10 or 11 ft., when the weight pressing upon its extreme end was some 200 or 300 tons?

To expect the rudder-post to prevent any lateral motion of the stern would be still less reasonable. So far, then, as the strength of the stern of the ship is concerned, may we not remove the rudder-post in such a ship as the "Northumberland"—*i.e.*, in a ship built of iron, and having no after bearings for the screw? But, further, is it necessary for the support of the rudder? And, first, it will be evident, from what has already been said, that although the rudder is supported directly by the sternpost, to which it is hung, yet that indirectly the stem of the ship has to hold both. If instead of attaching the head of the sternpost to the stern of the ship, and hanging the rudder to it, the rudder were taken hold of by the stern and the post were removed, does it not appear that the stern would be actually relieved? If the weight of the rudder were thus taken upon one of the decks, it would be possible to make a considerable reduction in the ordinary friction of turning on the braces. A socket in the end of the keel, for confining the heel of the rudder, would then complete the arrangement. After some considerations as to the use of *auxiliary* and *bow* rudders, of which it was considered very little could be expected, Mr. Barnaby passed to the question of the employment of special machinery for turning the ship, and, first, to the use of double screws. He stated that, from the recent trials of the "Flora" and "Kate," the following facts were established:—

1. That with both screws working ahead, there is no loss of steering power compared with ordinary vessels, the circle being completed in 3 min. 48 sec.

2. That when one screw was stopped, the time of turning under the action of the other screw and the rudder was a little greater—viz., 8 min. 58 sec., but the diameter of the circle in which the vessel turned was about one-third less than before.

3. That with one of the engines reversed, both engines driven at full speed, and the rudder hard over, the time of turning was still greater, viz., 4 min. 16 sec., but the vessel turned upon her own centre.

4. That the vessel could be turned on her own centre by the screws alone, the helm being amidships, but the time occupied in turning was 6 min. 55 sec.

5. That the vessel was under perfect command as well when steering astern, as when steering ahead.

The first thing observable here is, that when the screws are used to assist in steering, the vessel turns more slowly than when under the influence of the rudder alone. This arises to some extent from the fact, that the screw which is stopped or reversed is on the side towards which the rudder is turned, so that the rudder is rendered partially ineffective. It must also be borne in mind that this vessel is narrow in proportion to her length, the screws are therefore very close together, and their leverage in turning the vessel, small. On this account I think we might expect a better result in a broader vessel, where the screws had a greater leverage.

The real gain in this arrangement is, however, the reduction of the space passed over in turning. Our longest ships may by these means be made to turn on their own centres when employing the full power of their engines, instead of making a circuit of nearly two miles.

But we must not conceal from ourselves the fact, that, so far as our experiments have gone at present, we have found no means by which we can quicken the rate of turning in these large ships.

Improvement in this respect has still to be sought. Supposing we were to adopt both the double screw and the balanced rudder, we have no reason to suppose that these large ships could be turned completely round in less than seven or eight minutes. The actual velocity with which the head of the ship moves round in obedience to the helm, *i.e.*, the velocity of the extremities of the ship in a direction at right angles to the length of the ship, Mr. Barnaby finds to be as follows:—

	Length of Ship.	Knots per hour.
Warrior	380 ft.	1.3
Resistance	280 ft.	1.3
Emerald	237 ft.	1.1
Liffey	235 ft.	1.1
Edgar	230 ft.	0.9
Racoon	200 ft.	1.2
Kate, most favourable	165 ft.	1.5
„ when turning with screws and rudder together	165 ft.	1.3
Columbine, with Mr. Lumley's rudder	160 ft.	1.2
Bullfinch, gunboat	106 ft.	1.5

I can imagine no way, said Mr. Barnaby, of increasing this speed, except the introduction of special machinery for turning. I have shown in a diagram a mode by which this might be effected. I find that a screw only 10 ft. in diameter, placed in the bow of the ship, and driven at the speed of 9 knots per hour, would perform the same work in turning the "Resistance," as her rudder would perform when placed at an angle of 24½ deg. and acted upon by the water driven from the screw at 18 miles an hour. If such a screw were connected with a small engine on the deck, or in the fore hold, there would be no difficulty in driving it at twice the speed named above, by which we might hope to obtain both the advantages we seek—viz., *increased speed in turning*, and the means of turning on a pivot from rest.

The disadvantages attending the adoption of such a plan lie upon the surface; but it cannot be doubted that it would give more complete command over the movements of the vessel than that promised by the double screws, while it could be used under sail as well as under steam.

In whatever manner future naval engagements may be conducted, the result of those engagements must largely depend upon the course which is now taken in providing machinery for steering. But in view of contests between ships *cased with armour* and *equipped as rams*, this question takes the very first place; and the issue of an engagement between two ships thus constructed, will depend less upon the power of their artillery and the amount of protection given to the guns, than upon the facility with which the vessels move and turn, and upon the provision made for resisting the blows of the ram. There would be but little time or opportunity for fighting guns. The engine and the steering apparatus must do everything.

And although in the view of operations against fortresses and forces on shore the armour and the ordnance must still retain importance, the vital necessity for the English Navy will always be the means of maintaining supremacy upon the sea, in order to secure our own coasts and commerce.

Nothing can apparently be more desirable for England than such a change in the condition of naval warfare as that indicated; for, in that case, the operations of rapid iron-cased rams would render the transport of large bodies of troops across the channel so hazardous as to make invasion next to impossible.

And this desirable change will also possess the advantage that large crews will become unnecessary, it being the duty of the constructor to furnish the small crew with the means of resisting capture by boarding. But all this lies in the future, and depends upon improvements in the machinery of steering.

The questions proposed by Mr. Barnaby for consideration were as follow:—

1. With regard to the ordinary rudder in screw ships. Can any improvement in the ordinary rudder, either in its form and dimensions or in the mode of applying power to it, be expected to give us such facilities in steering as the exigencies of modern naval warfare demand? And if such improvement may be expected, in what direction is it to be sought?

2. With regard to balance rudders. Looking at the great number of men required to work the rudders of large single screw-ships, at the loss of power by the leverage of the rudder, at the loss of efficiency through the smallness of the angle at which these rudders can be worked, and at the slowness with which such rudders can be put over, would it be desirable to substitute for them a balanced rudder in ships where the sternpost may be removed, and the rudder put immediately abaft the screw?

3. With regard to double screws. Supposing there is a loss of time in completing the circle by the aid of the double screw and a little loss of speed, is the advantage of being able to turn in that circle, without being compelled to move ahead, sufficient to render its adoption in large ships-of-war expedient?

4. With regard to a steering screw. If a steering screw working transversely in the bow of the ship promises to give the same advantages as the double screw with regard to turning on a pivot, and promises also to increase the rapidity of turning—an advantage which it seems impossible to secure in any other way; if, further, a steering screw may be employed when the vessel is not under steam, does it offer sufficient promise to make a trial of it desirable?

In the discussion which followed, and in which Mr. J. Scott Russell (the Chairman), Sir E. Belcher, Captain Symonds, Captain D'Orsay, Mr. Humphreys, Mr. John Dudgeon, Mr. Ditchburn, Mr. Andrew Murray, Mr. Grantham, and others took part, there was considerable difference of opinion on the questions proposed. Mr. Humphreys and Mr. Russell were of opinion that the most desirable arrangement for steering large ships was a large rudder turned by steam power. The former gentleman stated that he was now fitting apparatus for this purpose in six vessels, each over 2,000 tons burden, and said that the time of turning the rudder by this arrangement from hard to port to hard to starboard was 12 seconds.

Mr. Russell and Mr. Ditchburn considered that the sternposts of the large iron ships alluded to were unnecessary; and the second question, proposed by Mr. Barnaby, was answered in the affirmative by several speakers.

The advantages of the double screws were freely admitted; but the loss of speed likely to be caused by their use in large ships was urged as a serious objection to them.

Sir Edward Belcher recommended the ejection of water from apertures in the bow and stern, as an effectual mode of steering heavy ships; this, as was pointed out by Mr. Barnaby, amounted to the same thing as the steering screw referred to in his last question, which is in fact a simple and effective jet propeller.

Mr. Scott Russell expressed his fears that the steering screw would interfere with the speed of the ship, and considered that it was on that account undesirable.

THE MID-LEVEL COMPENSATION CASE.

A Norwich special jury, under the presidency of Lord Chief Justice Earle, have been engaged for five days in investigating an action—Coe *v.* Wise, Clerk to the Mid-Level Commissioners, for negligence in not making and maintaining the outlet sluice of the Mid-Level, by reason of which the tidal waters broke through and ran over the sluice, submerging the plaintiff's land. The importance of this trial may be estimated from the fact that no fewer than 107 compensation claims have been awaiting its decision. From the evidence it appeared that, in order to get rid of the drainage that for a long time used to fall into the river Ouse, as effectively as possible, the Commissioners cut a straight line, eleven miles in length, through the country known as Marshland, from Popham's Eau to the Marshland sluice running into the Ouse. An Act of Parliament was obtained for this purpose, which Act directed that a substantial sluice should be made at the end of the cut next the river. The corporation thereupon built a sluice as directed, which was done between the years 1844 and 1846, and consisted of a sort of bridge of three arches, each arch being stopped with doubble sluice doors, opening and shutting with the advancing and receding waters. The banks sloped on each side of this bridge gradually down to the bed of the river, which at the highest tide rose to about 18 ft. On Saturday, the 29th of March, last year, two holes were observed down against the south sea wing. The tide was ebbing, and the water was very muddy, boiling up under the north abutment of the south arch—showing that the water was going from the river into the cut under the bank. Two days later the holes were filled up to the level; and by the 27th of the succeeding month, the same holes had dropped again much larger. Two or three carts were then employed in filling them up, but they fell in again twice. According to the evidence of Samuel Smith, sluice-keeper at the Marshland sluices, who was present at the time of the accident, the whole wing wall went down in less than 20 minutes after he had warned the men that the waters had "burst up." "The earth," added the witness, "must have gone between the piles, and the piles were hanging by the bolts that fastened them to the top." On the Sunday, this witness saw the planks which formed the floor of the sluice in the cut move up. This was on the 4th of May, when the sluice was totally destroyed; and before nine days had elapsed 6,000 acres of land were submerged, and their crops entirely destroyed. It appears that between the 27th of March and the day on which the accident occurred, a great many men were employed in taking steps to prevent the occurrence.

For the plaintiff, Sir John M'Neil, Sir John Rennie, and a few other witnesses were examined. The pith of their evidence was that sufficient precautions were used to prevent the accident. Mr. Fowler, Mr. R. Lunn, the superintendents of the works; Mr. Hawkshaw, the engineer, and other members of the Institution of Civil Engineers, were examined, and on Monday morning the Lord Chief Justice put it to the jury,—First, was damage caused to the plaintiff by the absence of due care and skill on the part of the defendant in making the sluice; secondly, in maintaining the sluice; thirdly, in providing remedies against mischief after the sluice was destroyed; and fourthly, by reason that no puddle clay wall was made along each side of the banks of the cut?—The verdict was declared for the defendant on the first issue, and for the plaintiff on the last three issues: virtually a verdict for the plaintiff. The question of damages is to be settled out of the Court.

The annual dinner of the members of the Institution of Civil Engineers, which was fixed for Wednesday, the 22nd inst., has been postponed, owing to a domestic calamity in the family of the President.

DYSON'S MACHINERY FOR FINISHING AND POLISHING CIRCULAR METAL RODS.

FIG. 1.

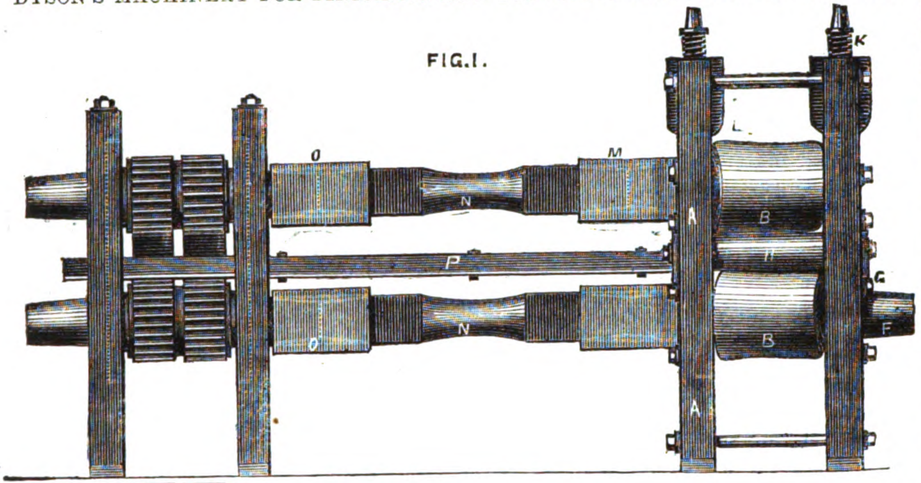


FIG. 2.

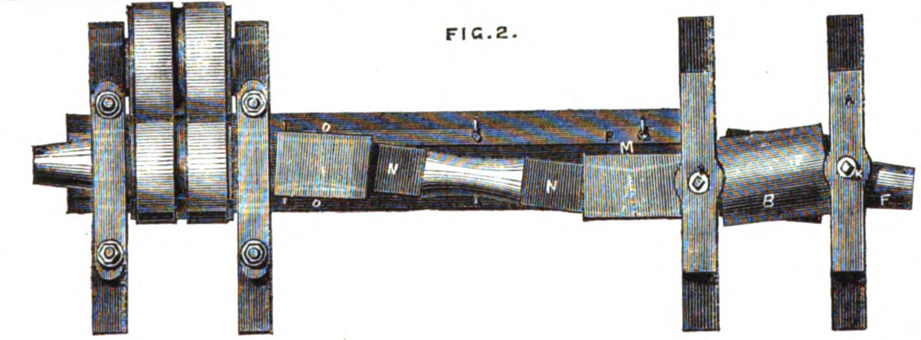


FIG. 3.

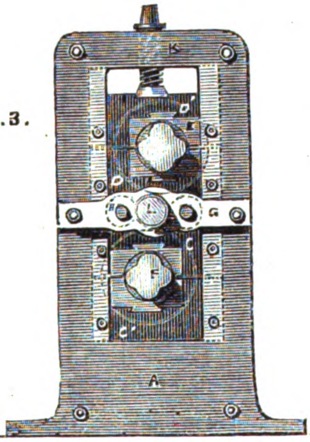
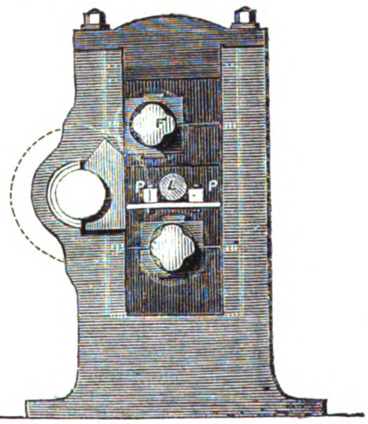


FIG. 4.



DYSON'S MACHINERY FOR FINISHING AND POLISHING CIRCULAR METAL RODS.

A PATENT has just been granted to Mr. G. Dyson, of Tinsley, Yorkshire, for an invention for "Improvements in machinery for finishing and polishing circular metal rods, bars, and shafts; applicable also to the manufacture of tubes and pipes."

The machinery consists of a pair of rolls, set slightly at an incline, and each inclined in an opposite direction to the other, both rolls being driven in the same direction. The rod, bar, or shaft is introduced between guides and between the ends of the rolls, and at right angles or nearly so to the direction in which the rolls are driven; then, upon the rolls being made to rotate through toothed gear, the rod, bar, or shaft is drawn between the rolls in a direction at right angles or nearly so to the circumference thereof, and is thereby rendered cylindrical, smooth, and polished.

The finishing and polishing machinery is shown in the accompanying engravings.

Fig. 1 is a front elevation; fig. 2, a plan; fig. 3 is an elevation of the "housings" for the rolls; and fig. 4 is an elevation of the housings for the pinions or toothed driving gear. These pinions are arranged to drive both rolls in the same direction, and being such as are generally used in driving rolls, need no further description.

A, A, are the housings for the rolls; B, B, are the rolls, the barrels of which are inclined horizontally, and each in an opposite direction to the other; C, C_1, and D, D_1, are the chocks supporting the brasses E, E, in which the necks of the rolls revolve; F, F, are the tenors of the rolls; G is a strap fixed to the housing. A similar strap, not shown, is fixed to the corresponding part of the housing. These straps receive the spindles of guide rollers H, H, which keep the rod or other article, while being acted on by the rolls, in its proper position between them. Guides in the form of flat bars or square blocks may be used in lieu of the rollers. To keep up the upper roll, spiral springs are inserted between the chocks C and D; K is a pressure screw for regulating the pressure between the rolls; L shows the position of a rod passing between the rolls. It will be observed that the axes of the rolls and of this rod are not in the same vertical plane; M, M, are coupling-boxes shaped on the inside to correspond with and receive the tenors on the inner sides of the rolls, and also the coupling spindles N, N, which are similarly shaped in section to the tenors; O, O, are other coupling-boxes connecting the spindles N, N, to the tenors of the driving gear; P is a support on which the rod or other article is received after passing between the rolls and guided out through the pinion housings. The rod, bar, or shaft should be first prepared by being made more or less round in the ordinary manner by means of grooved rolls, and while still hot is introduced between the outer ends of the the inclined rolls before described. The rotation of these rolls causes the rod, bar, or shaft to pass through the rolls and to issue from the opposite end circular, smooth, and polished.

When applied to the manufacture of pipes and tubes the machinery remains as before described, but in addition to the guides, a mandril is employed between the rolls over which the pipe or tube is drawn.

JENKINS' AND JUMELLE'S IMPROVED ENGINE GOVERNOR.

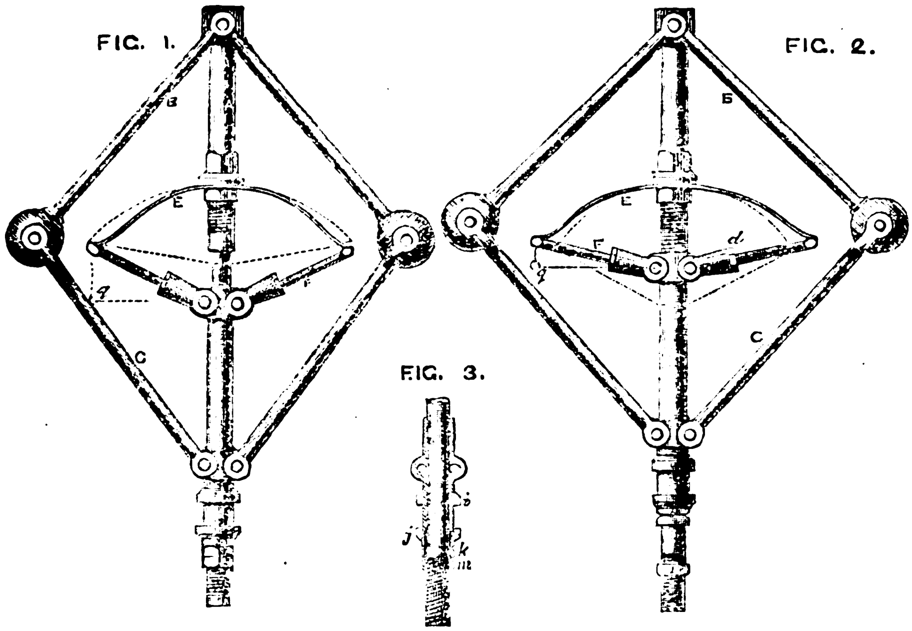
A PATENT has just been issued to Messrs. Jenkins and Jumelle, of Philadelphia, U.S.A., for an improved governor for steam engines, which consists in combining a spring with a governor spindle and rods so arranged as to form a knee, joint, so that the force applied to overcome the rigidity of the spring may be transmitted through a leverage constantly increasing as the resistance of the spring increases, thereby equalizing the action of the spring, a desirable object to be attained, under certain circumstances.

A represents the spindle of the governor, and B and B the weighted arms hung to the top of the spindle in the usual manner. To the weights *a*, *a* of the arms B and B are jointed the upper ends of the rods C and C, the lower ends of the latter being connected to the sleeve D, which is fitted snugly to, but arranged to slide freely on the spindle A; E is a spring connected at a point midway between its opposite ends to the spindle A by means of nuts, which are adapted to the screwed portion of the said spindle.

To each end of the spring is jointed a rod F, each rod being connected to a coupling G by means of a nut, each of the couplings are connected to a lug on the upper end of the sleeve D. The lower end of the sleeve has a recess for receiving the end of the usual governor lever, through which the movement of the sleeve is communicated to the throttle valve of the steam engine; this recess being formed by collars on the sleeve. The lower collar limits the downward movement of the sleeve, and consequently the inward movement of the weights.

On reference to fig. 1, the sleeve D is illustrated as depressed to the limit of its downward movement as regulated by the nut. As the governor revolves the weighted arms will fly out, and the sleeve will rise to an extent regulated by the speed of the governor and the rigidity of the spring E. Now, supposing this spring acted directly on the sleeve without the intervention of the rods F, it will be evident that the higher the sleeve rises, through the centrifugal force of the weights, the greater will be the opposing force presented by the increased rigidity of the spring as the opposite ends of the latter are raised, consequently the govenor will be irregular in its movement, the irregularity being in proportion to the difference in the rigidity of the spring as the ends of the latter are raised. By connecting the spring to the sleeve by means of the rods F, however, the case is different, as they form with the sleeve and spring the well-know knee-joint, so that as the sleeve is raised it acts on the spring through a constant leverage, gradually increasing as the sleeve rises, and as the rigidity of the spring increases. Thus, in fig. 1, where the sleeve is depressed to the limit of its downward movement, the force applied by the revolving balls tending to raise the ends of the spring, will be applied through a leverage equivalent to that represented by the dotted lines, the former representing the long arm of the lever

JENKINS' AND JUMELLE'S IMPROVED ENGINE GOVERNOR.



acted upon by the sleeve, and the latter the short arm acting on the spring, and the point *q* being the fulcrum of the lever. As the sleeve rises the long arm of the lever becomes gradually longer and the short arm shorter, so that by the time the sleeve has arrived at the position shown in fig. 2, the leverage on the spring will have been increased to the proportion represented by the dotted lines in that figure.

ON IRON-CASED SHIPS OF WAR;

Including a Description of H.M.S. "Enterprise," and some Remarks on Sea-going Shield Ships.

Mr. E. J. Reed read a very able Paper on this question at the Fourth Session of the Institute of Naval Architects on the 27th March last. We are sorry that our limits will not permit us to insert the Paper entire. After some introductory observations Mr. Reed said:—

"I will speak first of a few general features of construction which seemed to me worthy of adoption. These are: that we should employ iron armour of some kind, and to some extent, in every class of fighting ship that will carry it, large and small; that we should employ a few large guns wherever practicable in preference to many small ones, and give these large guns as great a range of fire as possible; that every class of ship should be protected with armour throughout her entire length in the region of the water-line; that the rudder-head and steering apparatus should be protected; that every vessel intended for sea-going purposes should stand up well out of the water, be well lighted and ventilated, and carry efficient masts and sails—in fact, be as unlike the ill-fated 'Monitor' in all these respects as possible; that every such vessel should be made strong enough to stand the shock of being used, upon an emergency, as a ram against vessels of her own class; that small war-vessels, if armour-plated, may be built of wood, but that, when a very high speed or very large dimensions are required, we should build in iron; that when built of wood, the hull should be made solid throughout in the wake of the armour; and, finally, that every sea-going ship-of-war should be so formed and have her weights so distributed that she will be well supported, as far as may be, at every part, and have no heavy overhanging parts to cause her to strain and work when knocked about in a sea-way."

After an emphatic condemnation of the new American vessels, like the "Monitor," Mr. Reed said:—"If any thought, or word, or act of mine can have weight, now or hereafter, directly or indirectly, in shaping in any measure the future of the British navy, it shall be employed in resisting every approach to a surrender of that power and predominance upon the open ocean in which we have gloried for ages past, and hope to glory for ages to come. I wish to insist upon this somewhat urgently, because we are tempted in many ways, and by many persons, to compromise the sea-worthy character and sailing qualities of our men-of-war. Ships without a mast or sail; ships with open upper decks not half-a-dozen feet above the water; ships without a cabin in which men can inhale a breath of fresh air, and without a mess-room in which they can eat a meal decently; ships which are much more likely to carry our flag down to the bottom of the ocean than to bear it proudly over it to distant climes—ships of this sort, I say, are continually thrust forward as great improvements by ignorant or designing persons, and not unfrequently find enthusiastic advocates. I trust, however, that we here assembled are agreed at least in this—that the war fleet of England should consist mainly of vessels in which our noble seamen, of all ranks, can live healthily and happily, and seek the open sea at all times with security and confidence."

Much has been said of Mr. Reed's preference for wood. He deals with his critics in the following manner:—

"When we want a ship to perform the service allotted to our sloops and corvettes in all quarters and corners of the globe—when we want a vessel to go steaming in and out harbours, and up and down rivers, and to go feeling her way over unexplored grounds—then I have not a moment's hesitation in deciding that she may with great satisfaction have her hull built of wood. I am not going to say I condemn iron altogether as a material even for ships of this kind, but neither am I going to condemn wood for the purpose, and I say it would be mere idle theorizing to deny that wooden bottoms are exceedingly valuable in small war-ships designed for foreign service. But then, on the other hand, if we wish to build a ship that shall be driven, say, at 14 knots of speed, there is not one among us, probably, who will doubt that iron is by far the best material for our purpose. It is only just to myself to state most distinctly my preference for iron und r such circumstances, because, from the fact that the first vessels built by the Admiralty from designs prepared by me happened to be of wood, some persons have fallen into the error of supposing that I am averse to iron ships. No greater mistake could be made. The very first design submitted to the Admiralty by me, was for a high-speed iron-cased ship of iron, and I have had in hand for some time past other designs which are to be of iron, and in the carrying out of which I have had the honour to receive great encouragement from the Controller of the Navy. For the truth is, there is no actual difference of opinion at all, that I can find, on this important question. Everybody is thoroughly convinced that, for such colossal and fast vessels as the 'Warrior' class and the 'Northumberland' class, iron is not only the best material, but the only material that we can wish to use, and I never yet met with any one who questioned that fact. No one ever proposed, I believe, to build such ships as those of wood. But then it would be utterly vain and futile to deny in this place, and before this assemblage, that great manufacturing difficulties and imperfections exist in connection with iron ships."

After some pertinent extracts from Mr. Scott Russell and Mr. Grantham, on some of the difficulties attending the use of iron in ship-building, the author of the Paper gave the following description of the "Enterprise":—

"The frame timbers of this vessel were to a large extent converted, so that I laboured, of course, under some considerable difficulties—a fact which, if I may say so, my critics have sometimes kept out of sight. The principal features of the 'Enterprise' were designed in this way: In the first place, I fixed upon four 110-pounder shell guns as a sufficient armament to replace the numerous small guns which the ship would have carried if completed as an unprotected wooden ship. These four large guns I determined to place in the centre of the ship, in order to give them, and the armoury which was to shield them, the support of the buoyancy which abounds at that part of the vessel. Upon the sides of the ship I placed 4½-inch armour to to protect the guns, extending it from a sufficient height above, down to the neighbourhood of the water-line. Below this armour I found I could place a tapering belt of armour plates, reaching from a foot or so above the water-line to 3 or 4 ft. below it, making it 4½ in. thick at the upper and somewhat less at the lower edge. This belt I extended over the whole length of the ship, from stem to stern, raising it an extra foot or two at the stern to shelter the rudder-head and tiller. To prevent the battery from being raked, I fitted transverse bulkheads at its extremities, just as such bulkheads are fitted in the 'Warrior,' and for precisely the same object, and over the guns I fitted a solid roof or deck, surfaced with iron, to protect them and the gunners. I next raised the decks a foot or two in order to bring the lower deck above the water, and coincident with the upper edge of the armour belt, and to this deck also I gave a surfacing of iron, in order to assist in causing any shot that might strike it to glance. The exposed unprotected portions of the ship I at first proposed to fill in solid, so as to render them less combustible; but I suggested that these light exposed upper works might be formed of iron, and thus made entirely incombustible, and this suggestion was approved by the Admiralty Constructors and adopted by the Board. There are, however, two other points which I must not fail to mention—namely, the adoption of an arrangement of transverse ports and short turn-down bulwarks, by which I am enabled, for the first time in naval construction, I believe, to get an almost fore and aft fire from a protected battery with a broadside gun; and, secondly, the method of solidifying the frame by means of dowelled fillings behind the armour. I also gave to the other timbers an increase of scantling.

* * * * * *

"As regards the other vessels which I am superintending—the 'Research' and 'Favourite'—they differ from the 'Enterprise' in some very important respects. I was fortunately disembarrassed, as regards those vessels, of several limitations that fettered me in the "Enterprise," and being anxious to produce a class of ship of which several might be commenced with confidence, I avoided in them the iron upper works, and have provided for plating them up to the upper deck; so that these two ships, of about 1,250 and 2,180 tons respectively, will be as completely plated with 4½-inch armour as the largest iron-cased ship in existence. Extra strength has been thrown into the bows of all these ships, so that they may be strong if used as rams; and you will see that, owing to the concentration of all the principal weights at the centre of the ship, that association of weight with buoyancy which Mr. Scott Russell and Mr. Grantham have so urgently recommended, and those improved steering qualities before mentioned have been attained in a very unusual degree."

Mr. Reed then vindicated the "Enterprise" from the attacks made on it by Admiral Halsted. "You have heard," said he, "my description of the vessel, and by what process she was designed, and you will be able to see for yourselves how entirely free she is from both the merits and the demerits peculiar to the cupola plan. In point of fact, cupola ships are the only kind of war ships to which the 'Enterprise' bears no sort of real resemblance; for between her and the ordinary broadside vessels there are comparatively few vital differences. I know, however, how the gallant Admiral got led into his error. It has so happened that, owing to the large quantities of bad iron which have been sent in repeatedly for the ship by contractors, and, of course, as repeatedly rejected, we have been unable to proceed as rapidly with the ends of the vessel as with the midship portion, which is of timber, and therefore free from difficulty; and the consequence has been that the battery of the ship has been left standing up like a tower, and so as to look to a hasty observer something like a square cupola, if I may imitate Admiral Halsted in the use of such a phrase. Ere long the ends of the ship will be built up and her appearance so much altered, that every one will wonder what Admiral Halsted could possibly have meant.

* * * * *

"Admiral Halstead says the 'Research' is three-fourths unprotected; the answer is, that the 'Research' is as completely protected on the broadside with 4½ inch armour as any ship in the service, for the armour rises quite up to the upper deck and to the top of the battery. Admiral Halsted says the 'Research' is being built after an attempt to combine iron topsides upon wooden bottoms; the 'Research' has, however, no iron topsides at all, and was never designed to have any. The 'Enterprise' is being built upon that principle; but the Board of Admiralty thought it prudent to get her to sea before they laid down other vessels on the same plan, and to await the experimental solutions of the problem. No second vessel of the kind, therefore, was commenced; and, with the strongest desire to be indulgent, I confess myself utterly incapable of conceiving why a gentleman should have rushed into print with a directly contrary statement.

"One other point requires attention. It has been a favourite practice with the one or two writers before referred to, to speak disparagingly of the strength of the 'Enterprise's' side; and my gallant friend has followed in their track. He and they seem to consider it a great discovery to have found out that the 'Enterprise's' side, although covered with 4½-inch plates, will not be quite so strong as the side of the 'Warrior,' or as the 'Trusty' shield; and they solemnly suggest that the Admiralty should spend a thousand pounds or so an an experiment to ascertain if their view is not correct. I can assure them that the Admiralty will not incur the expense, for they know perfectly well already that the 'Enterprise's' side is not fully equal in strength to those structures. Of course we have all along known, and everybody with a grain of common sense must know, that a wooden sloop's side, even when strengthened like the 'Enterprise's,' being without an inner iron skin, must be somewhat weaker than the 'Warrior's,' which has a stout inner skin. But I should like to ask Admiral Halsted and his allies, whether any sloop's side was ever made as strong and impregnable as a line-of-battle ship's? And I would ask them further, whether they do not consider it would be more fair and reasonable to compare the 'Enterprise' with the class of vessel which she is intended to replace—the old wooden sloop, with frames 5 or 6 inches thick only, and with great spaces between them, and with no armour at all—rather than to compare her with the largest iron-cased ship yet afloat—a ship ten times her size?"

From Admiral Halsted he proceeded to answer Captain Coles:—

"I may remark," said Mr. Reed, "that we must drop the notion with which Captain Coles seems to have started, and which was embodied in the 'Trusty' shield. We have no longer to do with cupolas, for he has now adopted turrets, or upright cylinders like the 'Monitor's,' which are very different things from sloping shields. They are different, first, because they no longer protect the gunners from vertical fire. The gunners may, of course, be protected from such fire by covering the turrets over; but this requires special armour for the purpose. The same armour no longer effects both objects. They are different also because they no longer have the advantage so much insisted upon by Admiral Halstead, of glancing the shot off them. Capt. Coles's turrets are now made 25 ft. in diameter, and therefore always present square to the enemy a surface, say 10 ft. wide and 6 or 7 ft. high, in which there is only a single foot of curvature. At short range, and with modern accuracy of fire, this surface would be struck by every shot, and always be struck square; for in whatever direction the enemy may lie, the turret will be much worse off than an ordinary ship's side battery, which can never be struck square except when the enemy lies quite opposite to it.

"We must also drop, for the present at any rate, the notion that we can fire more rapidly from a turret than from the broadside. This was done in the 'Trusty' because the gun was breech-loaded, and ran out of itself. But we are now to carry 300-pounders in turrets, and we have no breech-loading guns of that size, nor are we likely to have; and consequently it would be a pure assumption to suppose that we can fire faster in turrets than out of them. In fact, until we have had actual practice with 300-pounders in 25-ft. turrets, we cannot be sure that they can be loaded and fired with anything like the same convenience and rapidity as broadside guns, especially if we take to training broadside guns mechanically.

"Further, the change from cupolas to turrets has left us in doubt whether such apparatus will stand the fire of heavy ordnance. The blow of a 300-pounder upon an upright cylinder may have a very different effect to the blow of a 68-pounder, or a 100-pounder, upon a sloping shield. It may hereafter be proved that such a structure will stand such a fire, but at present the matter is in doubt."

He then proceeded to speak more particularly of sea-going shield ships in the following words:—

"Now, if a ship is to be fit to go to sea at any time and at all times, you must not give her a deck close down to the water, and nothing above it. In a shield ship you can have no permanent bulwarks above your upper deck, or else you cannot fire all round, which it is the special merit of the shield to do. Your upper deck itself, therefore, must be well up out of the water, and the longer you make the ship, and the higher speed you give her, the higher this deck must be. I should think the deck of no sea-going ship whose bulwarks must turn down in action ought to be less than 5 or 6 ft. out of the water; otherwise the sea would wash over, and destroy the health and comfort of the crew. If, then, we assume that the ship is to be plated up to this deck all round, and that the armour is to reach down as usual to, say, 4 ft. below the water, we at once get a depth of 9 or 10 ft. of armour all around the ship, in addition to the armour of the turrets. Here, then, at the very outset, all hope of a small sea-going turret ship wholly armour-plated, to steam at a fair speed, is at once annihilated. If we take a vessel no larger than the 'Enterprise,' for example, we at once find that we require about 400 tons of armour and backing (taking 4½ in. iron on 18 in. of teak) on the side only; and if we put into her but a single turret to carry a couple of 300-pounders, we must add, say 120 tons for its weight; so that our armour alone will weigh considerably over 500 tons. Now, I am sorry to say—and no naval architect will contradict me—that we cannot possibly carry this amount of armour on a vessel of the size of the 'Enterprise,' and still preserve the buoyant, and steaming, and sailing, and steering qualities which she possesses. Our smallest shield ship, carrying but a single turret, if wholly plated, and made sea-worthy, must be considerably larger than that vessel. I have not seen a one-turret sea-going iron-plated ship; but I have seen a two-turret vessel of that kind building in the dockyard of one of our very foremost private shipbuilders; and I will tell you what she is like. She is, if I remember rightly, about 240 ft. long; is of considerably more than *twice* the tonnage of the 'Enterprise,' has an upper deck only about 4 or 5 ft. from the water, and armour only 3 ft. below it; has only 9-inch teak behind 4½-inch armour; has but comparatively little steam power; has no prospect of sailing well; and yet has had that all-round fire which is supposedto be the chief merit of cupola ships sacrificed to a very large extent by the erection of permanent bulwarks forward and aft. In fact, the power of firing either ahead or astern is not possessed by her, for without these permanent bulwarks she would be unsafe at sea; and it remains to be seen whether she will be safe even under this disadvantage."

Our space will not permit us to give the remainder of this very able Paper.

ON THE ACTION OF SULPHURIC ACID UPON LEAD.

By T. Crace Calvert, F.R.S., F.C.S., &c., and Richard Johnson.

It has been generally supposed by scientific men, but we do not know upon what grounds, that metals are less acted upon by acids in proportion to their greater degree of purity; and it naturally follows that smelters strive to attain to a continually increasing purity in the metals they produce. This is especially the case in the manufacture of lead, because the process which purifies the lead enables the smelter to extract from it other substances, such as silver, rendering the operation profitable in itself.

It is, however, very desirable to ascertain whether the opinion generally held respecting the diminished action of acids on metals in proportion to their purity, is really correct or not as regards lead; and hitherto we are not aware that any experiments have been made with the view of determining this question. We have, therefore, thought that it might be interesting in a scientific point of view, as well as practically useful, to study the action of acids, and especially that of sulphuric acid, upon some of the leads of commerce, which, as is well known, are largely employed in the construction of those immense chambers in which sulphuric acid is manufactured.

With this object in view, we have instituted a series of experiments to ascertain the action upon lead of sulphuric acid of various degrees of concentration and purity, in different volumes, at various temperatures, and for various periods of time. We have made use of two kinds of commercial lead, choosing as types the two extremes in respect of purity, viz., common sheet lead, representing ordinary impure lead, and virgin or Derbyshire pig lead.* We have also

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* The analysis of the two classes of lead upon which most of our experiments were made yielded the following results:—

	Common lead.	Virgin lead.
Lead	98·8175	99·2060
Tin	0·3955	0·0120
Iron	0·3604	0·3246
Copper	0·4026	0·4374
Zinc	traces	traces
	99·9760	99·9800

thought it desirable to examine the action of sulphuric acid upon chemically pure lead; and we may at once state, as the result of three or four repetitions of such series of experiments, all agreeing closely with each other, that we have arrived at a conclusion directly opposed to the generally received opinion; for we have found that the purer the lead in contact with sulphuric acid, the more it is acted upon. Thus the action on pure lead is from two to three times as great as that upon the common kinds, as will be seen by the following results:—

Thirty square centimetres of each of the different kinds of lead, were acted upon (at ordinary temperatures of 64° to 68°) by 50 cubic centimetres of perfectly pure sulphuric acid, and at the end of ten days the following quantities of lead were dissolved:—

Table No. 1.

Density of the acid employed.	Common lead.	Virgin lead.	Pure lead.
	gr.	gr.	gr.
1·842	I.—0·199	0·400	0·600
	II.—0·207	0·405	0·610
	Mean... 0·2030	0·4025	0·6050
1·705	I.—0·029	0·048	0·060
	II.—0·021	0·051	0·058
	Mean... 0·0250	0·0495	0·0590
1·600	I.—0·015	0·028	0·050
	II.—0·016	0·034	0·047
	Mean... 0·0155	0·0310	0·0485
1·526	I.—0·007	0·015	0·018
	II.—0·006	0·011	0·023
	Mean... 0·0065	0·0130	0·0205

The next Table gives the above results calculated for a metre of surface (instead of 30 centimetres) acted upon by a proportionate quantity of acid (16·666 litres).

Table No. 2.

Density of acid employed.	Common Lead.	Virgin Lead.	Pure Lead.
	gr.	gr.	gr.
1·842	67·70	134·20	201·70
1·705	8·35	16·50	19·70
1·600	5·55	10·34	16·20
1·526	2·17	4·34	6·84

These results leave no doubt that the purer the lead the more it is attacked, and that in a ratio which is very curious and instructive.

In another series of experiments, made with the same leads, and under the same conditions, with this difference, that the period was fifteen instead of ten days, the following are the results calculated for a square metre:—

Table No. 3.

Density of acid employed.	Common lead.	Virgin lead.	Pure lead.
	gr.	gr.	gr.
1·842	89·00	194·34	279·00
1·705	11·67	16·84	24·00
1·600	6·17	12·17	20·00
1·525	3·17	8·67	8·67

These results confirm the above.

If, instead of a natural temperature, we operate at a temperature of about 120 deg. for eight days, we still find, as in the preceding instances, that the action of the acid on the purer lead is more energetic than on the ordinary qualities:—

Table No. 4.

Density of acid employed.	Common lead.	Virgin lead.	Pure lead.
	gr.	gr.	gr.
1·842	418·34	458·50	507·34
1·705	6·84	10·67	13·00
1·600	5·84	6·34	11·84
1·526	3·50	4·84	6·67

The question occurred to us, whether the purity of the acid employed had occasioned such unexpected results, and whether the substition of ordinary commercial acid would not show a different relative intensity of action. We, therefore, used some acid from the leaden chamber, and which had undergone no purification, its density being 1·593. The following results were obtained from two series of experiments, continued for fifteen days, at the temperature of from 113 deg. to 122 deg.:—

Table No. 5.

Density of acid employed (from leaden chamber).	Common lead.	Virgin lead.	Pure lead.
	gr.	gr.	gr.
1·593	I.—11·84	15·84	19·50
	II.—11·34	16·17	19·84

If we employ twice the quantity of acid to the same surface of lead, other conditions remaining as in the preceding experiment, we find that the action increases in each case with the purity of the lead, but not in the proportion of one to two. The following table gives the mean results of two distinct series of experiments:—

Table No. 6.

Density of acid employed (from leaden chamber).	Quantity of lead dissolved in 15 days by the action of 33·333 litres of acid upon one square metre of surface.		
	Common lead.	Virgin lead.	Pure lead.
	gr.	gr.	gr.
1·593	I.—20·17	22·50	27 00
	II.—22·17	24·34	27·67

We repeated these experiments, employing acid not as it comes from leaden chambers, but after having been once evaporated in open leaden vessels in which its concentration is commenced commercially. The following table gives the mean figures obtained from two distinct series of experiments, with one volume, and with two volumes of this acid, in each experiment the acid used was obtained from a different source:—

Table No. 7.

Density of acid proceeding from open leaden vessels, in which its concentration is commenced in commerce.	Quantity of lead dissolved by the action of 16·666 litres of acid for 15 days at temperature of 113 deg. to 122 deg. upon one square metre of metallic surface.		
	Common Lead.	Virgin Lead.	Pure Lead.
	gr.	gr.	gr.
1·746	I.—49·67	50·84	55·00
	II.—51·91	54·75	57·41
	Quantity of lead dissolved by 33·333 litres instead of 16 666 litres of acid, the other conditions remaining as above.		
	gr.	gr.	gr.
1·746	I.—54·67	56·17	59·34
	II.—56·25	58·67	60·67

We have confined ourselves to a few particulars without entering at length into all the details of our experiments. We may, however, state that they were all repeated many times, and that we varied the surfaces of lead, the quantities of acid, the temperature, the duration of action, and, in fact, all the conditions of the experiments; and yet we always obtained similar results, from which we draw the following conclusions:—

First, and this is the principal point to which we invite the attention of scientific as well as practical men. Of the various kinds of lead existing in commerce, the purer they are the more they are acted upon by the sulphuric acid. Lead chemically pure is more acted upon than any of the others.

2. Although it is stated in many chemical works that sulphuric acid only acts sensibly upon lead at a temperature above 383 deg., our experiments tend to prove the contrary, since we find that acid of sp. gr. 1·842 dissolves *cold* 67, 134, and even 201 grammes of lead per square metre of surface; and, in another instance, that acid of sp. gr. 1·705 takes from the same surface 54, 56, and 59 grammes of lead at a temperature of about 120 deg. only.

3. Finally, the action of sulphuric acid upon lead appears, at least, when there is no continuous agitation of the mass, not to increase in proportion to the quantity of acid employed. This is probably due to the formation of a layer of sulphate of lead, which protects to a great extent the surface from further action by the acid.

The various experiments which form the subject of this Paper lead to conclusions so unexpected that we think it advisable to state the circumstance which first induced us to undertake the investigation.

In the course of the year 1860, a very extensive chemical manufacturer consulted one of us respecting his leaden chambers, one of which had been in use for fifteen years, and remained apparently in good condition, whilst another, less than one year old, was attacked on all sides, its interior being furrowed with fissures.

Having taken a piece of lead from the sound chamber (No. 1), and two samples from the injured one, the first (No. 2) from a part still uninjured, and the second (No. 3) from a place attacked by the acid, we submitted these samples to analysis, and were surprized at the following results:—

	1.	2.	3.
Lead	98·87	99·37	99·45
Tin	0·91	traces	traces
Iron	0·12	0·37	0·32
Copper Zinc	Traces	0·16	0·17

These figures show that the chamber which had so long resisted the action of the acid was made of lead differently and more largely alloyed than that of which the other chamber was made. The question then arose which we have endeavoured to answer in this Paper.

There is yet another question to be solved, viz.:—What metal is it which, mixed with lead, enables it to resist the action of the sulphuric acid, and in what proportions should that metal exist in the mixture—is it, as the foregoing analysis would appear to indicate, tin? We hope at a future date to be in position to answer this question.

Meetings for the Week.

Mon.—*Medical Soc.*—Clinical Discussion, at 8 p.m.

Tues.—*Inst. Civil Engineers.*—I. Discussion upon Mr. Miller's Paper "On Structures in the Sea." II. "Description of the Line and Works of the Scinde Railway," by J. Brunton, Esq., at 8 p.m.
Royal Inst.—"On Animal Mechanics," by Prof. Marshall, at 3 p.m.

Wed.—*Soc. of Arts.*—"On the new Art of Auto-Typography," by Geo. Wallis, Esq., at 8 p.m.

Thurs.—*Royal Inst.*—"On the Relations of Geology with Allied Sciences," by D. T. Ansted, Esq., at 3 p.m.
Inventors' Inst.—"On the Effect of the Periodical Payments at the End of the Third and Seventh Years, respectively, on the Patent System, and Interests of Inventors," by Thomas Webster, Esq., M.A., F.R.S., at 8 p.m.
Antiquaries.—At 8.30 p.m.
Chemical.—At 8 p.m.
Linnæan.—At 8 p.m.
Royal Soc.—At 8.30 p.m.

Fri.—*Royal Inst.*—"On the Culture of Fish," by F. Buckland, Esq., at 8 p.m.
Architectural Assoc.—Conversazione.

Sat.—*Royal Inst.*—"On the Science of Language," by Prof. Max Müller, at 3 p.m.

A New Safety Mining Lamp.—Welsh magistrates resident in the great coal basin of South Wales have lately had their attention called to the sad thoughtlessness of miners. At a colliery near Aberdare an explosion occurred a short time ago, by which nine men were injured and two killed; and it was elicited at the inquest that one of the deceased in all probability caused the explosion by opening his lamp for the purpose of "having a smoke." Numerous single instances of men tampering with their lamps for the same purpose have also been brought to light. The latest lamp invented possesses a marked superiority over its predecessors. A collier in North Wales, by name Isaac M. Evans, is the inventor. The Davy has this objection, that the gauze covering or envelope renders the light obscure, and practical colliers say that they cannot fill so many trams in a week by its light as by the light of a common candle. Hence it has been known for colliers working in a dangerous stall to open their lamps or put them aside and use a candle instead. Evans's lamp obviates this difficulty or defect. Around the light is a thin glass tube, purposely made thin so as to admit of expansion. Over this again is a stouter glass envelope, strong enough to bear being knocked about with impunity. At the top are two gauze cones, and at the base the air is admitted to the lamp by means of punctures. The point of the invention, it would appear, was to construct a lamp that should give equal light to that of a candle, that should warn the collier of the presence of gas, and, on the assumption that he with usual rashness would disregard the warning, should go out and leave him in the dark. These conditions are said to have been fulfilled. With a lamp as this is hoped to be, and a more rigid system of detection, selecting men from amongst the colliers themselves as inspectors over their own and their fellow-workmen's safety, the foul gas of our coal mines may become of less import, and coal fires less suggestive of disaster and death.

TO CORRESPONDENTS.

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To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Correspondents who wish their manuscripts to be returned are requested to state this.

We beg our correspondents to choose initials, rather than general signatures such as "Constant Subscriber," or "Reader," &c.

Received.—J. C., V. P., C. W. L., J. N., H. K., Capt. B. B., M. M., Prof. C. C.

W. M. N. (Manchester).—Many thanks for letter and enclosure. Contents noted.

W. A., Civil Engineer.—We have forwarded your communication to the proper quarters. We will insert any *short* letter in which you prove your priority of the invention of *end grain wood backings*, and of *flat-end shot punches.*

T. G. (Hull).—Declined.

J. H. (Huddersfield).—Personal vituperation is not argument, and, above all, not *scientific* argument. The *argumentum ad hominem* is always weak, but more especially so when discussing matters of science. We have the pleasure of knowing Mr. Z. C., the gentleman to whom you have alluded in terms that we will not characterize; he is a man of unquestioned talent, both practically and theoretically, and in all other respects he is very far from deserving your harsh expressions.—The very favourable opinions we entertain of the Richards' indicator have been founded on practical experience as to its merits. In conclusion, we hope that you will eliminate all personal feeling out of any communications you might wish us to insert.

W. S. E.—How much metal do you mean by writing a "small quantity of aluminium?" This is just about as definite as saying "a piece of cheese." The price of aluminium is now about 5s. an oz., in 1856 it was £3 an oz.; buttons and studs, &c., are thus sold for a few pence. You will find a great deal of new information about aluminium in pages 149 to 160 of the new "Dictionary of Chemistry," by H. Watts (Longman). As far as we can ascertain, the easiest and cheapest way for you to obtain a small quantity of aluminium for experimental purposes would be simply to buy one of the cheap ornaments of this metal that are generally sold in the shops. We may mention that the great expectations that were at first entertained about this substance have been rather dispelled. We believe that there is no known process of soldering it; the different small parts have thus to be rivetted together, and it also tarnishes very easily. It is noticeable that the inalterable qualities of any given metal are generally in a direct ratio to its density; the specific gravity of aluminium is only about 2·48. It is thus lighter than glass, and is only about one-fourth of the weight of silver, and its fusing point is also lower than that of silver. Common clay contains this metal to the extent of from 20 to 25 per cent., so that our houses may be said to be built of aluminium, or rather of alumina.

L. S. (London).—Mr. A. C. L. Devaux has taken out three patents for improvements in granaries for storing and preserving grain. No. 2486, 1s., in 1855; and Nos. 850, 1s. 4d., and 1087, 9d., in 1856. By sending these several sums in stamps, addressed to Mr. Bennet Woodcroft, Her Majesty's Patent Office, London, printed copies of the drawings and specifications will be forwarded to your address.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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SUBMARINE TELEGRAPHY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In your impression of the 27th March are several letters bearing on a subject in which I have long taken much interest, that of Ocean Telegraphy; and as "H. K's." letter proposes a system of laying submarine cables which is, in my opinion, utterly impracticable, I shall ask you to allow me to make a few remarks on the reasons which have led me to such a conclusion. At the same time I shall endeavour to show "H. K." that I am not actuated by any prejudice against his plan, or for my own; but that as I am willing, nay, anxious, to hear all objections, so I claim the right to make them when necessary.

The question this writer professes to discuss is, as to where the cable should be laid—whether along the bottom or near the surface. I intend to show him that, first, it is not desirable to lay a cable at or near the surface; and, secondly, that if it were desirable, it is not possible by his method. Of course, to establish the second proposition would be sufficient, but I take this mode of argument because it is necessary to show what is and is not desirable, as well as what is or is not possible.

First, he assumes that if the cable were laid with "5 or 6 buoys" 20 or 30 fathoms under the surface, it would be accessible for repairs. As the buoys are under water it will be utterly impossible to find them by any other mode than grappling at right angles to the line in which the cable is known (or supposed) to have been laid. When he has had as much dredging and trawling in deep water as has fallen to my share during my surveying service, he will know how hazardous an operation this is. He will, probably, also find out that such men as Capt. Maury ought not to be pooh-poohed, and do not assert the existence of currents of all depths and in every part of the ocean without knowing perfectly what they are saying. If he will read Sir Edward Belcher's letters, he will find other and most important testimony in the same direction; and if my own experience may have any weight, I beg personally to assure him that at no depth, in no conceivable place, is there such a state as absolute stagnation of the ocean. In every part there will be some current; and in some parts, of a distance of 2,000 miles, there is sure to be a current, perhaps above, possibly below, of very considerable velocity. But, generally, we may affirm that the greater the depth, the less the disturbance probable from this cause at or near the bottom. However, as currents would evidently be fatal, "H. K." depreciates the probability of their existence; and after thus entering my protest, I am content to leave that part of the question.

We will then, for the purpose of argument, leave out the existence of currents, and assume that if the cable were laid on H. K.'s plan it would not be strained or moved by them.

Now, how are we to lay it? Each buoy will require its anchor and 2,000 (*circa*) fathoms of chain or wire rope, to keep it from coming to the surface. That is to say, six buoys and 12,000 fathoms of chain in all. In the middle of paying out, it may be in a gale, I am to stop and let go an anchor with 2,000 fathoms of chain (this will take about an hour in getting to the bottom), and then, if the cable is still in existence as a whole, I am to attach a buoy to it and let go. Three hundred and thirty miles from that spot I am to repeat the operation.

The result is, supposing all to go on as H. K. would have it, that at six points along the route the cable has to support twice the weight of itself in water at the particular depth, or, it may be, four miles length. I think the cable-makers would justly object to such treatment of their carefully-planned structure, even supposing that the difficulty of making the mooring strong enough could be overcome. Chain, which, merely for the sake of argument, I have supposed to be used, could not really, any more than a bar of iron, support two miles of itself in water for any length of time; and if steel wire were used, it would have to be protected from salt water as expensively as the cable itself. I need scarcely point out that this is a complication, not a simplification, of the process of deposition of submarine cables which it is most desirable to avoid. But, leaving out other objections which will occur to most seamen, as to the stowage, handling, &c., we now come to the reason why it is not possible.

Let "H. K." take a piece of water, 2,000 in. wide and 2 in. deep; let him lay a thread across it; now let him try, by supports at 300 in. apart, floating in the water, to keep it from touching the bottom—he may even try 30 in. apart, *i.e.*, 66 buoys instead of 6—and if then he does not renounce his scheme, I will attempt to convince him by some other reasoning.

He is quite right in appreciating highly the criticisms of "Old Sailor" on Dr. Wallich's plan. He only reproduces what many other seamen told the doctor before. As to its utter impracticability, I quite admit that "groundless assumptions are the bane of science;" and I fear that "H. K.," in trying to get off the ground and going out of his latitude, will find the truth of the assertion practically and personally demonstrated.

The letter of "Philo," in your columns, I cannot say I am surprised at. The manner in which he has told some most bitter truth may, and probably will, produce a great deal of annoyance; but those concerned should take it as a warning, that so much would not have been said in the case of a project which every one is anxious to see successful, by whomsoever undertaken, if there was not very great ground for dissatisfaction; and to the arguments used on the absence of the nautical element from all consulting committees, I have long given my hearty concurrence. The public is never satisfied if after failures in whatever undertaking, the causes of those failures, possible and probable, do not receive full elucidation, and are not shown to be carefully guarded against. Expressions, however confident, of satisfaction with the very means which probably contributed to those failures—a reliance, however childlike the faith which prompts it, on the adage, "Better luck next time,"—are not likely to be efficient in adducing that hearty support which a great national undertaking is entitled to expect and ought, under other circumstances, to receive. Nor will the highest names on the list of abstract science, the brightest promises of experiments in the future, be so attractive of national confidence as well regulated experiments made in the sight of all, for the benefit of all.

But it is said, Give us your money, and we will try any experiment you please. That cannot be. Your experiments must give confidence, and then the confidence will give you money.

For such experiments, properly conducted by men who have no other than a scientific interest in the question, I believe individuals would gladly subscribe money, and the Government might properly be asked for aid. They have already done something in this direction, and would probably do more, if it were to forward the general good rather than particular views. But there are many experiments which might be tried with little expense—so little as to be easily within reach of the influential moneyed supporters of submarine telegraphy, if only there were among them that united action which must be arrived at before we can expect any great successes. All who were interested in the matter hoped to have seen a committee appointed, not by any company, but by the scientific bodies; before whom all the questions could have been fairly brought and dispassionately argued, in which all the elements of science concerned should be fairly represented, and at which no man should sit by virtue of any other title than his knowledge of some branch of the subject.

The mode of action should not be, in my humble opinion, as in the last Government committee, to ask general questions, but to take each separate proposal, and thoroughly, and by examination of all who were willing to give evidence on that particular subject, to bring out the fact that it was, or was not, worth a practical trial. Take, for instance, a particular cable, hear *pro* and *con*, strike the balance, and decide how it shall be tried, or whether it is worth while to try, on which side truth rests—whether the advocates of the idea are sensible men, or its opponents right in their objections; gradually, even slowly it is true, but surely, would fallacies be thus struck down, and true theory receive its confirmation.

Many points have already been settled, and only require authoritative enunciation. For myself I do not fear—rather, I court such a test. For though I am like all of woman born, personally desirous of success, I am still more desirous that the truth may succeed, and only in so far as I believe in the truth of what I advocate am I anxious for its adoption.

It is because I feel thus—because I believe that truth is the one thing to be disinterred from the mass of error, not to say misstatement, which has done so much to impede the progress of telegraphy—that I cannot but admire the reasoning of "Philo's" letter. Of its agreeability there are, no doubt, two opinions; of its ability there can be but one; and however rough the operation, it is the part of a true friend, to lay bare error, to rub vigorously the frost-bitten feature. All I can say is, that, whenever any one is kind enough to undertake the operation for my benefit, I am duly grateful. I can get many who will applaud success and make things pleasant —very few who will be at the trouble to point out error—still fewer who will help one to a way out of it.

J. H. Selwyn, Capt. R.N.

AN ATLANTIC TELEGRAPH.

Sir,—Having shown in my last communication that, in ocean telegraphy, laying the cable near the surface is to be preferred, and having pointed out what appears to be the best mode of doing so, I shall now proceed to consider the question—what is the best telegraphic route from Britain to America? And, in doing so, it must be altogether unnecessary to enlarge on the importance of a right settlement of this question—apart from all personal considerations or local prejudices—because we must all be perfectly conscious that, if by any want of judiciousness in any respect, a second cable should be laid, and should it fail to work, it will have a most disastrous effect in postponing telegraphic communication with America *sine die*.

Whatever the routes may have been which have been suggested, the two following seem to be preferable to all others—namely, that by Ireland to Newfoundland, to be herein termed the southern; and that by Scotland, Ireland, and the south point of Greenland to Newfoundland or Labrador, to be termed the northern. The latter, it may be mentioned, was originally proposed by the writer; and the terminus in Newfoundland is preferable to one in Labrador, for reasons to be afterwards assigned. The election thus lying between these two routes, it is further believed that, if the decision turns—as it is thought it certainly ought to do—upon the question, which line would be most easily and cheaply, and least riskfully constructed and laid, would work most efficiently and pay best, and would be attended with least risk in all other respects, the northern is superior to the southern, and deserves to be preferred on the following grounds:—

The northern route being divided into three sections, the cable could be made and laid section by section, and no more than one section need be so made and laid until such section was first seen to work; and being found to work it would necessarily impart the utmost confidence as to the working of the other two sections when these should also be made and laid; and the working of the three *separately* would imply, as a matter of course, the working and success of the whole line. Now, all these vastly important results, arising from the laying and working of the first section only, could be obtained by the expenditure of a very small amount of capital, not even so much, it is believed, as £100,000. And the north cable being thus made sectionally, it would, if anything, be better made; and being laid sectionally it would, beyond all doubt, be laid so much the more easily and cheaply, and with much less risk; for in laying the separate sections, ships of much less size, and also much less time, would be required than on laying the whole cable at once, thus also diminishing the danger from storms, from which, it will be recollected, the "Agamemnon" and "Niagara" suffered so much in laying the former continuous southern cable.

Again, by the north route being divided into sections, it is well known that messages could be transmitted much more quickly, much more certainly, and much more constantly, than by the long continuous southern line—supposing the latter did work to some extent. Further, when the sections are laid, if any injury should happen to any one of them, it would be confined to that section alone, and in that case the injury would be much more easily, cheaply, and expeditiously repaired than it would be in the case of one long continuous line like the southern.

The superiority of the north line over the south, in every essential point, is thus seen to be most manifest, and that upon plain, unexaggerated, and most conclusive grounds. But we shall now proceed to consider what are the advantages of the south line. And these, it may perhaps be asserted, are four—namely, it would be 200 or 300 miles shorter than the north line; it would have fewer shore ends; it would not be directly connected with any other than British and colonial territory; and it may be said it would be less liable to danger from ice.

Assuming, in the meantime, that all these advantages are in favour of the south route, they do not nearly counterbalance the essential and important advantages of the north, as above set forth. But, in point of fact, a less distance of 200 or 300 miles is no advantage whatever, if the enterprize, from its consequent great continuous length, is of the most doubtful success, and is attended with extremely great and constant risk. Again, its greater number of shore ends would enable the north cable to perform its work far better than the south—supposing the south, under all its disadvantages, to work at all, or for more than a few weeks, that being the whole extent of the working of the former south cable. And though the south cable would not touch other than British and colonial, while the north cable would at two points touch Danish, territory, that is surely not an objection to be listened to in this age. On the Continent, railroads and telegraphs run in all directions through different kingdoms. And if the north line is constructed by the British Government, with special reference to Britain and its colonies, the line would, of course, be entirely under its control, though affording the utmost amount of accommodation possible to all others who would be requiring and would pay for its use. Again, as regards the south line being less liable to danger from ice, this is a mistake; for it is liable to be visited at its western terminus by icebergs. But if proper and easily-adopted precautions are taken in landing the north cable at or about Cape Farewell, in Greenland, and if it is then made to run to Newfoundland, and is landed there under similar precautions, it is believed, after most careful consultation of the best authorities, that all danger from ice would be altogether avoided. But if the line were conveyed to Labrador, it would there, no doubt, run the greatest danger from ice, as the north-east winds, prevalent in that quarter, bring down the icebergs from high northern latitudes, and drive them against, and accumulate them in great masses, upon the Labrador shore. Besides, the cable, by being landed in Newfoundland would reach the inhabited parts of America much sooner than if it were carried to Labrador. It is therefore, to be hoped that, in respect to the landing of the north line in Newfoundland, the interests of Europe and America will not be sacrificed to the paltry impotent rivalries of private companies or private individuals. If they are unable to do any good, we will do them the justice of believing that they will not attempt to do evil, and to become wretched obstructives.

On the whole of the grounds now submitted, it is thought that nothing could be clearer in science, in reason, or in ordinary commercial rules, than that the northern route, as now pointed out, should be preferred, and that more particularly on the extremely important ground of its admitting of the telegraph cable being made and laid, section by section, as already adverted to. I may add that it may, with great confidence, be expected that, by the adoption of surface telegraphy, the south line will also yet be made, and will be found to work with permanence; but even though this confidence should exist, it would be most unwise to adopt this course in the meantime, encountering very great unnecessary risk, when another course is open attended with far less risk. It need scarcely be said that to encounter great unnecessary risk, especially in important matters, is a course utterly opposed to science, reason, and sound commercial principles, and is, in truth, a sign of the most childish folly—if it should not be called by a harsher name—when we ask others to peril their money in connection with such risk.

It may, in conclusion, be mentioned that the writer, in penning the preceding remarks, is perfectly impartial, as he has no peculiar interest whatever in any of the routes beyond what the facts justify and require. His sole desire is that a work so great, so honourable, and so useful as a working telegraph to America would undoubtedly be—one that would affect so beneficially the Empire and the World —may, by the adoption of the very best means in our power, be speedily accomplished, and be crowned with complete and permanent success. But if we do not adopt the very best means in our power, we we are not entitled to expect nor even to deserve success, but, on the contrary, must lay our account with disaster and failure and all its evil consequences, together also with disgrace; for, while there is no disgrace, but the highest honour, in failing in a noble cause, where we have neglected none of the means in our power to ensure success, and have so calculated the matter as not to put it in the power of any to gainsay, it is altogether different when we act in an inconsiderate manner, and foolhardily encounter the most unnecessary risks. And let it always be kept in view that this, in reality, is not a mere trifling private company or individual—it is a national and an imperial affair, in which the national and imperial character and interests are thoroughly and deeply involved.

Edinburgh,
3rd April, 1863.

H. K.

Miscellanea.

M. Dollfus reports to the *Societe Industrielle* of Mulhouse his success in using the heavy oil extracted by M. Lebal from the asphaltum and bitumen, at Pechelbronn. He says that it is perfectly successful and very economical as an unguent for heavy machinery. He applied it to the inner surface of his boilers and heaters by warming them so as to make the oil more fluid, and then applying it in a thin coat by means of a common broom. The results were very satisfactory; the calcareous crusts were gradually detached and the metal everywhere exposed. "I continue to use the oil whenever I clean a boiler, and I judge that the expense, which which is about 10 kilos. (20 lb.) for a boiler of 45-horse power, is largely compensated for by the economy of fuel in consequence of the metal being clean; repairs are also much less frequent, as the boilers do not burn out so freely."—*Bulletin de la Societe Industrielle de Mulhouse.*

Yellow spots on leather frequently occur, and these detract from its value. A correspondent of the *Shoe and Leather Reporter* says they are caused by decomposition in the hide, probably in the sweating process. The remedy, he says, is "more care in the manipulation or working of the hides. With good, cold spring water for soaking, and with a sweat-pit kept at the right temperature, with ice or otherwise, and a cool, sweet liquor for the first stages of handling, there is but little danger of being troubled with yellow spots on leather."

It has often been a subject of remark and surprise that some plan is not devised so lessen the breakage of coal in the transit from the truck to the hold of the vessel. Many of the Monmouthshire veins are so friable and tender that when a cargo arrives in Ireland, it is often found that the brash or small coal is 25 per cent. of the total. This, as may be imagined, is a serious loss, and the breakage is principally caused in connection with the shipping. The agent of the Cork Steam Company is said to have invented a plan, by means of a tube peculiarly constructed, which will greatly reduce the breakage. The coal is conveyed through this tube to the hold of the vessel, and it is found that the average small is reduced to from 2 per cent. The tube is now exclusively employed in loading on the Cork wharf.

On Wednesday last some trials took place at Chatham dockyard in the presence of several of the heads of departments at that establishment to test the lifting powers of a new description of pulley, designed in the first place by Mr. Moore, of Bristol, and some years after patented by Mr. Weston, and now manufactured in Birmingham for the firm of Messrs. Shepherd, Ransome, and Co. The pulley tested on Thursday was one calculated to raise weights under four tons, and that with less than half the power required under the ordinary arrangement of blocks, as used in the dockyard. The pulley was suspended from one of the cranes, and the "endless" chain attached to one of the four-ton iron armour plates just landed. The ropes, or rather circular rope, attached to the pulley were then taken in hand by four men, and in half a dozen turns of the wheel, and without any undue exertion on the part of the workmen, the slab was hoisted to the required height. Another ton weight of iron was then added, and the large wheel which sets the pulley in motion again made to revolve, when five men in a few turns raised the slab and the additional pigs of iron, the whole being held in its place without any need of men retaining their hold on the rope.

The ironmongers' meetings for the current quarter commenced at Wolverhampton on Wednesday last. The attendance was comparatively small, and the amount of business transacted was limited. Even in pig iron, which generally forms the staple business of the Wolverhampton meeting, the transactions reported were less than usual; and for the manufactured commodity there has been a fall-off in the demand for the last two or three weeks, and it is only the principal firms who have sufficient orders in to keep their works in full operation; so far as they are concerned, prices are steadily adhered to. Another class of makers are not getting such good prices as at last quarter-day. The pig masters are suffering from the high price of ironstone, the yield of the district; for every description there is a good demand; its increasing scarcity is becoming more felt, and those who raise it are endeavouring to obtain higher prices, which consumers are unwilling to yield to; the market price of Staffordshire pig-iron being such as to prohibit any further rise in the price of materials, the more especially as the pig masters have to encounter increasing competition with their brethren in the trade in North Staffordshire, also with the Forest of Dean and the Cleveland Districts. The sales of "pig" reported at this meeting were at much the same prices as last quarter-day, but there was less buoyancy than on that occasion, and this branch is not nearly in so satisfactory a state as could be desired. There has been some degree of uneasiness in the trade during the week, consequent on the notice given by the puddlers for an advance in their wages scale. These expired last Saturday, and in some of the works the men have not yet gone in; but it is not anticipated that this demand will be persisted in, and that at latest all the men will have resumed work by next Monday or Tuesday. The state of the trade is not such as to admit of any advance, and on the part of the masters there exists a firm determination not to yield any. The great meeting of the trade will take place, as usual, in the Town-hall, Birmingham, on Thursday.

At a recent meeting of the Microscopical Section of the Manchester Literary and Philosophical Society, Mr. Charles O'Neill exhibited a mounted fibre of Orleans cotton, torn by a gradually increasing weight suspended to its extremity. It had sustained a weight of 162 grains for many minutes. Mr. O'Niell stated that there were 143 such fibres in ·01 grains of cotton, each fibre therefore weighing less than the ten thousandth part of a grain. The strongest fibres were capable of supporting more than two million times their own weight. He is engaged in making experiments upon the tensile strengths of various fibres by a special apparatus, but they are not yet completed.

Westminster Bridge.—From a Parliamentary return, published in December, 1862, the amount expended on the works connected with this bridge was—

To contractors	£145,057	18	5
To other parties	248,132	0	9
Making a total of	393,189	19	2

The length is 1,160 ft. 3 in., and the width between the parapets 84 ft. 2 in. The cost would therefore be £338 15s. per foot run, or about £4 per foot superficial, whereas, in the late Sir William Molesworth's report, the estimated cost was stated to be £235,000, or £2 8s. 6d. per foot superficial. In addition to the sum of £393,189 19s. 2d., there has been £109,054 4s. 9d. paid for approaches. The whole amount has been supplied from property belonging to the Westminster Bridge Commissioners and Votes of Parliament.—*A Record of the Progress of Modern Engineering*, by W. Humber.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2499, 2503, 2536.
Boilers and Furnaces—*none.*
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2515, 2517.
Ships and Boats, including their fittings, 2533.
Cultivation of the Soil, including agricultural implements and machines, 2501, 2521.
Food and Beverages, including apparatus for preparing food for men and animals, 2491.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2504, 2507, 2519, 2523, 2532.
Buildings and Building Materials—*none.*
Lighting, Heating, and Ventilating, 2528, 2529, 2534.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2497, 2509, 2512, 2513, 2536.
Metals, including apparatus for their manufacture, 2510, 2511, 2516, 2518, 2620, 2524, 2527.
Chemistry and Photography, 2535.
Electrical Apparatus, 2508.
Warfare, 2495, 2506, 2530.
Letter-Press Printing, 2498, 2514.
Miscellaneous, 2492, 2493, 2502, 2522, 2525, 2526, 2531.

2479. J. Maurice. *Improvements in the construction and preservation of ships and vessels.* Dated September 9, 1862.

This invention consists in forming round the sides of a ship or vessel, or attaching to the outside thereof, a solid, or hollow belt, which may be divided transversely as well longitudinally, and should be fixed about the light-load water line, to give increased buoyancy or ability to carry armour plating for vessels of war, or to enable ships to carry additional weight applied externally or internally, whether such ships be for commercial or war purposes. *Patent abandoned.*

2480. J. F. Selby. *Improvements in traction engines and in valves for traction engines where compound engines are used, which latter improvements are applicable to compound engines generally.* Dated September 9, 1862.

These improvements in traction engines relate to such traction engines as are driven by cog or spur wheels, which wheels are usually allowed to vibrate with the spring of the engine to a certain extent, thus creating great wear and tear and loss of power, by the constant jolting and vibrating of the wheels. This great objection is obviated in the present improvements, which consist in forming the axle of the driving wheels in three parts, connected together by what is generally known as Hook's joint, or by any other suitable joint. The centre and shortest length (which has on the middle of it the cog wheel or wheels) is held up and supported in framing, or between two brackets or bearings, and thus revolves constantly in the same position geared into the cog or spur wheel or wheels of the crank shaft. This position of the wheels is not altered however great the jolting of the engine or vibration of the springs. The Hook's joints are fixed on to the ends of this short part of the shaft outside the brackets or bearing, and connected on to the other two lengths of the shafting respectively, on which the driving wheels are placed in the usual manner. The improvements in valves relate to compound engines whether employed in traction engines or otherwise, and consist in constructing the slide valve ports, steam chests, and chambers so as to regulate the admission and exit to and from the cylinders as may be required. The cylinders can be placed one within the other (the outer one therefore being an annular cylinder), or they may be placed side by side or in any other position found most convenient. The pistons and rods may be connected together (in the usual way) to one crank, or they may be conneced to separate cranks, and the cranks may be fixed either in the same or in opposite directions, or at right angles, or any desired angle to each other, or indeed in any position desired. *Patent completed.*

2481. W. Hirst. *Improvements in machinery to be employed in the manufacture of paper or linen spool tubes, which machinery is also applicable for the manufacture of cartridge cases.* Dated September 9, 1862.

We cannot here give space to the details of this invention. *Patent completed.*

2482. J. Walker. *Improvements in the manufacture of oil presses.* Dated September 9, 1862.

According to this invention, the inventor proposes to enable the presses to be worked independently of each other by means of an improvement in the junction pipes or passages, whereby the oil may be shut off when desired from or between either of the presses, so that one press may rise while the other falls, or so that one may be kept stationary while the other is rising or falling. *Patent abandoned.*

2483. T. Fleitmann. *Improvements in the manufactare of copper from copper ores..* Dated September 9, 1862.

This invention is more particularly applicable in the manufacture of copper from those ores which contain silver or gold, and which have as impurities arsenic, antimony, and phosphorous, which, according to the ordinary roasting and smelting process, are very difficult to separate entirely from the copper. The copper ores employed are first ground to a powder, then part of such powder is subjected to a roasting process, and is roasted dead. The roasted product is mixed with the unroasted portions of the ore, and together with suitable materials for producing a slag, such as silica, and cinder of a previous smelting process; it is then subjected to heat in order to be melted. The melted mass is run into water, and the product is ground to powder. Part of this powder is subjected to a roasting process, and is roasted dead. The unroasted and roasted products are then mixed, and together with fluxing materials, such as silica and cinder or slag from a previous smelting process, are subjected to heat and melted. The melted mass is run into water and again ground into powder. The powder thus obtained when necessary is divided into two equal parts, one of which is roasted dead and then mixed with the unroasted powder, and the mixture is melted as before. In this manner the ore is again and again treated till the resulting sulphuret of copper is in the condition desired. The sulphuret of copper obtained is ground to a powder, is roasted dead, and moistened with a solution with an alkali, for which either carbonate or caustic soda or potash is used. In those cases where the quantity of silver or gold present is important, then the same is to be extracted in the ordinary manner before roasting the sulphuret of copper dead. The oxide of copper is subjected to heat so as to melt the alkali, but not the oxide of copper, which is then to be well washed in water. The product obtained is mixed with powdered carbon (wood charcoal being preferred) and then melted, applying either coal or carburetted hydrogen or pure hydrogen, which is preferred to be done in a blast furnace of comparatively small height, the interior of which is lined with fire brick or fire clay. *Patent abandoned.*

2484. J. Saunders. *Improvements in lamps.* Dated September 10, 1862.

The patentee claims the construction and use of lamps having annular reservoirs, which are combined or connected by means of a central arrangement of syphons and air tubes with a wick receptacle or cup of any convenient form or size, as described. *Patent completed.*

2485. J. Saunders. *A new or improved railway break.* Dated September 10, 1862.

The patentee describes this invention as a simple, inexpensive, continuous railway break, to be made to act by the power of the locomotive, and requiring no fixing between the carriages, but ready to act upon the carriages being screwed up together as is usual. The details are too voluminous to be given here. *Patent completed.*

2486. M. Smith. *Improvements in machinery for raising the nap on woven fabrics.* (A communication.) Dated September 10, 1862.

This invention consists in an improved combination and arrangement of machinery combined with heating cylinders for raising the nap on cotton or other woven fabrics. The fabric to be operated upon first passes between stretching bars, then over a heated cylinder, then over and under other stretching bars between which the surface of the fabric is presented to the action of rollers covered with card teeth, or other agents for raising the nap. The fabric is then taken over another heated cylinder, and under and over other stretching bars, between which are other raising rollers; drag rollers are also provided at intervals to keep the fabric to the requisite tension. The number of heating cylinders, raising rollers, drag rollers, and stretching bars may be increased or diminished according to the nature of the fabric to be operated on, and to the finish required. The drying and warming of the fabric during the operation render the fibres more susceptible to the action of the raising cards or other agents. *Patent completed.*

2487. W. Rothera. *Improvements in machinery or apparatus for rivetting boiler plates, tanks, and similar articles.* Dated September 10, 1862.

This invention is carried out as follows:—Upon a suitable cast-iron frame the patentee places a ram in sections, and a shaft with cams and eccentrics upon it, so as to push one section of the ram upon the boiler plates, and hold them together until the other part of the cam or eccentric pushes up the interior of the ram against the rivet, and completes the rivet, or presses it to its place. At the back part of the machine, he puts two large levers which press against the pedestals of the cam or eccentric shaft, and hold them in their places until the pressure is put upon the plates, which at this point of the action presses back the pedestals of the cam or eccentric shaft, and slightly raises the levers. Upon each lever are suspended two large weights, one of which rests on a cast-iron bed or frame, and the other is always suspended upon the lever which determines the pressure which is put upon the plates. In pushing up the rivet which is performed in the same revolution of the machine, the pedestals of the cam or eccentric shaft are pressed a little further back, which raises the levers a little more, carrying all the weights along with them, and thus putting more pressure upon the rivet than it does upon the plates. Or the machine may be made, along with these motions before stated, to have a shaft put up inside the dolly or holder-up with an eccentric, so as to have a motion at both sides of the plates. He also causes the plates to be held tightly together, and the rivet rivetted or clenched up at the same time, by employing suitable cast-iron frames; and he places upon them two steam-cylinders and pistons and rods, one set beyond the other, so that the back rod intended for the rivet shall work through the front rod, which is intended for the plates, the rod being pressed against the plates, holding them tightly together until the back one comes up and presses the rivet up. *Patent completed.*

2488. H. Hands and H. Holland. *New or improved compositions for the manufacture of black ornaments, such as brooches, bracelets, ear-rings, and other ornaments usually made of jet, which said compositions may also be applied to the manufacture of various other articles.* Dated September 10, 1862.

This invention consists of the compositions hereinafter described, which compositions resemble jet, and may be used for the manufacture of the articles commonly made of jet, as well as other articles commonly made of ebony or other black material or composition. In making a composition to be used in the manufacture of black ornaments and other articles usually made of jet, the patentees take jet or scrap jet and reduce it to a very fine powder. They mix the said powdered jet with varnish and india-rubber and gum in a certain manner, so as to make a plastic material which may be moulded into any required form. *Patent completed.*

2489. J. Vigouroux. *An inoxydable white metal suitable for making taps or cocks and other useful articles.* Dated September 10, 1862.

Here the patentee obtains an inoxydable metal of a sort of steel white, of a high grain, capable of a high polish, and of becoming an ornamental metal, by combining antimony and nickel, and giving them tin for a basis. *Patent completed.*

2490. A. Barclay. *Improvements in traction engines, and in apparatus for indicating the pressure of steam.* Dated September 10, 1862.

This invention has reference to a previous patent, dated March 10, 1862 (No. 646). Under one modification of the present invention as applied to traction engines of the "right-angled class," the crank-shaft of each pair of engines has its bearings at one end arranged in the side standard or frame, whilst the other end is connected to the main axle, or to the centre of the driving wheel, so that this end of the shaft vibrates with the motion of the spring of the driving wheel, whilst the other end remains a fixture in its bearing. The other pair of engines has its crank-shaft arranged in like manner, the fixed bearings being on opposite sides of the machine. In this way the vibrating motion of the wheels as they traverse over the inequalities of the road is imparted to one extremity of each crank-shaft, but without affecting the opposite ends which revolve steadily in their bearings. The object of the arrangement is to prevent the vibration of the driving wheels from affecting the beat of the valves. *Patent abandoned.*

2491. G. Ritchie. *Improvements in extracting the liquid portion of yeast, spent hops, or other similar matters, and in the apparatus employed therein.* Dated September 10, 1862.

This relates to a mode of subjecting yeast, spent hops, or other similar matters, to filtration, so as to extract therefrom the liquid portion. Under one system of arrangement, the yeast obtained in brewing is placed in a filtering vessel, which may be formed either of metal. stone, slate, or wood, coated to render it impervious to air. Inside the filtering vessel is fitted a false bottom. This false bottom is properly fitted in its place, and the space between it and the filtering vessel is put in communication with an air-pump. On the surface of the false bottom two, three, or more piles of filtering cloths are placed, and the yeast is then poured on to the cloths. The air is exhausted from beneath the false bottom by the air-pump, the atmospheric pressure on the upper surface causing the fluid portion of the yeast to be driven rapidly down through the interstices of the cloths and the false bottom. In this way the whole of the liquid portion of the yeast is utilized and an important saving effected. *Patent completed.*

2492. G. T. Bousfield. *Improvements in machinery used in the manufacture of files.* (A communication.) Dated September 10, 1862.

The first part of this consists in an improved method of holding the file blank which is to be cut up to the face-plate near which the cutter strikes, so that, if the face of the blank be not true, the bed in which the blank is held may accommodate itself and present that portion of the blank which is operated on squarely to the cutter. The second part consists in a device for regulating the blow of the cutter, so that it may strike harder on the wide part of the plank than on the narrow part, where less force is required to make a cut of equal depth; the third, in an improvement in the face place. *Patent completed.*

2493. A. Rigg, *jun.* *Improvements in apparatus for carrying and tipping coal and other minerals, and in steam brakes used therewith, and with other machinery.* Dated September 10, 1862.

This consists of a platform sustained on axles or rollers which carries the waggon or other receptacle containing substances to be upset, the centre of motion being so adjusted that, when full, the weight of minerals overturns the whole, and when empty returns to the original position, unless otherwise restrained. Towards that portion of the waggon which descends lowest in overturning is fixed a riddle, moveable with the machine, and attached to it at any angle either curved or straight. For the the larger series of machines, the patentee prefers steam brake which possess a cylinder closed at both ends, and a large passage communicates steam to the upper or impelling side, and a smaller opening supplies the lower or retreating side, and to this side is connected a large escape tap or valve, to be regulated at will; or the inlet to the lower side thereof may be made to reduce as the exhaust or escape valve opens. *Patent completed.*

2494. G. T. Bousfield. *Improvements in machinery for cutting files.* (A communication.) Dated September 10, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2495. W. A. Munn. *An improved apparatus for capping, loading, and closing cartridges for breech-loading firearms.* Dated September 11, 1832.

This invention is not described apart from the drawings. *Patent completed.*

2496. T. Steel. *Improvements in treating soap suds or other saponaceous or oily matters.* Dated September 11, 1862.

This consists in the use of a perforated vessel, in which the inventor first subjects the "magmire" to the action of steam, whereby the lighter parts of the oily or greasy matters are carried off, and the magmire becomes heated and prepared for being placed in the press to extract the residue of oily or greasy matters by pressure. *Patent abandoned.*

2497. G. Weeks. *Improvements in constructing frames, trays, pots, or holders for flowers, plants, or shrubs, growing or otherwise, with arrangements for their display, and also for drainage.* Dated September 11, 1862.

This consists in constructing these frames, trays, &c., with a hollow stand, pedestal, or support, which shall or may raise them at a convenient height above the table or ground, and shall serve as a reservoir or receptacle for the water with which they may be watered to drain into; and also in constructing them with a hollow chamber or passage for water, formed entirely or principally of a pair of plates or thicknesses of metal or porcelain, &c., which may be parallel to each other or not, the lower one being so dished or inclined as to drain or flow off the water into the reservoir above mentioned, and the upper one having perforations, through which the water may pass, and also having partitions upon it for separating the flowers, &c. *Patent completed.*

2498. C. H. Humphrey. *Improvements in printing machinery.* Dated September 11, 1862.

This consists in the mode of raising, guiding, and lowering the printing roller during the backward and forward motion of the horizontal table. For this purpose, the inventor employs a pin projecting from one end of the printing roller, which pin, as the roller revolves, is caused to take into a curved slot or guide fixed on one of the upright brackets which carry the bearings of the axis of the printing roller, and as the pin advances up this curved slot or guide, the printing roller is raised and guided out of gear with the horizontal table, and when the pin arrives at the highest point of the curved slot or guide, it is caused to remain there until the horizontal table arrives at a certain relative position, when it is lowered down vertically and into gear again with the table. With this arrangement for raising, guiding, and lowering the printing roller, the bearings of the axis of the said roller have a reciprocating vertical motion imparted to them, and the result of the improvement is that the machine is caused to register with greater accuracy than hitherto. The other improvement consists in an arrangement for guiding the horizontal table more accurately than heretofore. *Patent abandoned.*

2499. F. Daticky. *Improvements in steam engines.* Dated September 11, 1862.

This invention consists of an apparatus which the inventor connects to steam engines, and to the boiler or boilers of such engines, for the purpose of assisting in creating a vacuum behind the piston, of utilizing the escape or waste steam, and of condensing it and returning it to the boiler. He connects to the boiler a cylinder for receiving steam direct from the boiler; this cylinder is in the form of an inverted cone at bottom, and has fitted in it a piston, terminating in a conical foot, which corresponds with and enters the conical bottom of the cylinder. At top the piston has a regulating screw, whereby it may be raised more or less up in the cone, and so allow of the issue of steam from the cylinder being regulated. This cylinder is fitted in a larger cylinder, into which the escape steam is free to enter, the outlet from this outer cylinder is narrowed, and leads into a condensing chamber, in which also the conical bottom of the first-mentioned cylinder is made to enter. The condensing chamber is fitted with four or more valves for the admission of air. Opposite the conical bottom of the steam engine, and in the condensing chamber, there is a conical vessel with a bell mouth, in which a corresponding conical plug is fixed. Like the piston, the position of the plug can be regulated to allow of the outlet being increased or diminished; the conical vessel leads into a conduit for conveying the water to be fed into the boiler. The action is as follows:—Steam from the boiler being admitted into the conical bottom cylinder, and escape steam into the cylinder surrounding it, the steam issuing from the conical bottom of the cylinder creates a blast, which draws in the escape steam from the steam engine into the condensing chamber, and at the same time air through the valves in the chamber, the steam in the chamber becomes condensed, and passes off through the conical vessel and conduits to be fed into the boiler. *Patent abandoned.*

2500. J. Hemsley. *An improved fabric or material for scarfs, ties, handkerchiefs, and neckerchiefs.* Dated September 11, 1862.

This improved material is a looped silk fabric, which the patentee ornaments by printing with spots, sprays, or with any other desired design, pattern, or device. The intended article is produced in the frame of its proper size, or the article may be cut from the piece. *Patent completed.*

2501. R. A. Brooman. *Improvements in implements for cultivating the soil.* (A communication.) Dated September 11, 1862.

This invention relates to steam tillage, and consists of an implement composed of two main parts: the first, intended to cut out the earth vertically, is in the form of a rectangular box without any bottom; three of its sides are cutting, for the purpose of penetrating, on pressure being applied, into the soil to the depth required. The second main part consists of one or more screws set to bore down into the soil within the space encompassed by the box; on being raised the screws turn over the soil, and transfer it into a furrow at the back of the box. The implement advances, the box is inserted into fresh ground, the screws descend, and, on ascending, take up soil and turn it over into the furrow last formed by them, and so on. *Patent completed.*

2502. W. Clark. *Improvements in cigar and cigarette cases.* (A communication.) Dated September 11, 1862.

The distinctive feature of this new kind of cigar holder consists of a case closed at one end and furnished at one part (the side, or either end, for example) with a small frame with hinges, similar to those used in purses, this opening frame extending only on one end or side or part of the case. *Patent completed.*

2503. L. C. Hoyau. *An improved portable apparatus for marking time, to be called "a memento bijou."* Dated September 11, 1862.

This consists in the construction of a portable apparatus or jewel, which the patentee calls more particularly under the name of indicating marker or memento bijou, the object being to assist in remembering the date, the day, the month, or the year, and also, if necessary, the exact hour and minute of an appointment, and, in short, under all circumstances where these dates may be found useful. It consists of six wheels or rotating circular dials, on the lateral circumference of each of which are respectively marked the indications to be read off. The apparatus can be made of any form and of all sizes. In varying the form —which may be circular instead of elliptical—it can be made to represent a seal with or without engravings, a brellock or a medallion, on which can be placed a portrait of any other object, in the free space, in the openings through which the figures or indications are seen; it can be made of metal, and covered with magnifying glasses, by which the indications can be more plainly seen. *Patent completed.*

2504. J. Thomson. *Improvements in the treatment of vegetable fibres with a view to their manufacture into textile fabrics.* Dated September 11, 1862.

This relates to a combination of certain chèmical and mechanical processes for treating vegetable fibres, whereby such fibres can be made to resemble the fibre or staple of cotton, wool, or silk, and become better adapted to the manufacture of textile fabrics, either by themselves, or mixed with other and more costly materials. *Patent completed.*

2505. A. Barclay. *Improvements in locomotive boring and winding engines.* Dated September 11, 1862.

This relates to the arrangement and construction of boring and winding engines, which are also arranged to be self-propelling. Under one modification the boiler of the engine forms the framing, or it may be carried on a rectangular framing in the ordinary way. The boiler is of the horizontal tubular class, and on the upper part is arranged a pair of standards which carry a horizontal shaft forming the axis of a beam; one end of this beam is connected to the piston rods of a pair of vertical cylinders placed on the upper part of the boiler at one end. The other end of the beam overhangs the end of the engine, and to this free extremity are attached the boring rods and tool. A horizontal cylinder is arranged parallel with the boiler on each side; the piston rods of these cylinders are connected to a crank shaft extending across the boiler. A pinion on the crank shaft drives a spur wheel on a shaft fitted between the beam standards and carrying the winding barrel; this pinion slides to and fro on a feather, so that the winding barrel may be readily thrown into and out of gear by a coupling and hand lever. The crank shaft also carries a pinion or spur at each end, which gears with an annular wheel formed inside each of the main or driving wheels of the engine, so that, by putting these engines into gear with the bearing wheels, the engine becomes a traction engine. *Patent abandoned.*

2506. W. Richards. *Improvements in firearms and cartridges.* Dated September 11, 1862.

In constructing breech-loading fowling pieces and other small firearms where the barrels are mounted, so as to turn on horizontal axles under their breech ends, as in breech-loading fowling pieces of ordinary construction, the patentee uses, in order to lock the barrels in position for firing, a self-acting spring catch or bolt, taking into a notch in a piece projecting from the upper part of the breech end of the barrels; this piece as the breeches are closed for firing, enters a recess in the top or the breech plate or false breech the recess and the piece entering it are both inclined so as to draw the breeches tightly against the breech plate. The spring catch is mounted in the tang of the breech plate by preference, so as to slide longitudinally therein, a spring tending constantly to throw it forwards; in closing the breeches of the barrels, however, it recedes, both it and the piece at the breech end of the barrels being suitably inclined; immediately the barrels are closed it again springs forward into its recess, and so holds the barrels securely. The catch is drawn back to open the breeches by a thumb-piece on the top of the stock. *Patent completed.*

2507. J. and F. Walker. *Improvements in machinery for combing and carding or hackling flax, silk, wool, and other fibrous substances.* Dated September 11, 1862.

This relates to the machine known as Pseller's combing machine, and consists, under one modification, in causing the frame carrying the combs to revolve, so that the teeth of the combs may strike upwards or downwards into the ends of slivers, which, proceeding from the feed rollers, project over the edge of a table or bridge; and the patentees place above or below the bridge on which the slivers rest an axis, having arms projecting from it upon which brushes are carried. These brushes are of sufficient length to extend across the slivers. As the axis which carries the brushes revolves, the brushes in turn come round to their highest or lowest position. The details of this invention are too voluminous to be given here *in extenso*. *Patent completed.*

2508. P. Ward. *Improvements in the manufacture of a double sulphide of calcium and sodium.* Dated September 11, 1862.

Here the patentee produces double sulphide of calcium and sodium from the substance known as soda ash waste. According to this invention he takes this substance when in a fresh state (as when exposed to the air it becomes decomposed, and is then not so suitable for any purpose), and he mixes it with sulphate of soda in suitable proportions, and heats the mixture so as to obtain a double sulphide of calcium and sodium. *Patent completed.*

2509. T. Molineux. *Improvements in pianoforte actions.* Dated September 11, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2510. A. Whytock. *Improvements in the construction of coated and uncoated sheet-iron boxes, and in the mode of, and apparatus for, straightening coated and uncoated sheet iron.* Dated September 11, 1862.

This consists—1, in straightening the sheets or plates of iron by passing them between a series of rollers having a rotary motion, and which, by friction of contact cause the plate to move in a serpentine or wavy line, the deflections of which will decrease as the sheet nears the last rollers of the series. The invention consists—2, in partially or wholly lining the sheet-iron boxes with wood, in order to prevent disfigurement by buckling and bruises. *Patent completed.*

2511. A. E. H. B. Butler. *Improvements in machinery for straightening and polishing cylindrical bars of iron and other metals.* Dated September 12, 1862.

After bars of iron or other metal have been rolled by pressing between grooved rollers in the ordinary way, they are generally crooked, and the surface is not perfectly smooth; now, in order to render them straight, and to polish or give a high finish to the surface, the patentee places them on leaving the grooved rollers between two rolls, the length of which must be equal to or rather exceed the length of the longest bar to be operated upon. Above the two rolls is a third roll, which is pressed down upon the bar. The rolls are caused to revolve rapidly, and in revolving they impart a rotary motion to the bar between them, thereby rendering it perfectly straight, and imparting a high finish to its surface. As soon as one bar has been operated upon, the top roll is raised by weighted levers or other equivalent; the finished bar is then removed, and another put in its place. The bars may be operated upon when cold, and the arrangement of gearing for driving the machinery may be modified. *Patent completed.*

2512. J. B. Smith. *Certain improvements in washing and mangling machines, applicable in part to steam dyeing, and to bleaching, to be styled the "Sensation washing and mangling machine."* Dated September 12, 1832.

This invention is not described apart from the drawings. *Patent completed.*

2513. J. Thom. *Improvements in mounting or fitting artificial teeth.* Dated September 12, 1862.

This invention is carried out as follows:—A model of the mouth to which the teeth are to be fitted having been taken in wax (or other plastic material), and the artificial teeth placed in their proper positions, a cast is taken therefrom in plaster of Paris in the usual manner. After the mould has been completed and become hard, the wax is removed, and its place supplied with india rubber and sulphur, which is heated to a temperature of about 330 deg. Fahr., when the india rubber becomes semi-fluid, and takes the form of the mould; at the same time it becomes vulcanized and hardened. In cooling, the vulcanized india rubber is found to shrink or become distorted from the original pattern, and therefore does not accurately fit the mouth from which the model was taken. In order to remedy this defect, and give the required accuracy to the artificial gum, the patentee submits it to the following additional and corrective process, which he claims as constituting his invention. Having trimmed the vulcanized india rubber, and made any necessary corrections thereto, he replaces it (the teeth being imbedded in their proper positions) in the plaster mould, within a metal collar of conical shape, which by means of a screw press brings the parts of the plaster mould in close contact with each other and with the vulcanized india rubber. While subjected to this pressure, he heats it to about 220 deg. Fahr., which so far softens the vulcanized india rubber as to cause it to conform itself strictly to the mould. In this state it is left to cool and harden; and being taken out it retains the form of the mould, and accurately fits the mouth from which the original model was taken. *Patent completed.*

2514. J. R. Johnson and J. S. Atkinson. *Improvements in machinery for manufacturing printing types.* Dated September 12, 1862.

This invention has reference to the patent granted to the present patentees on Dec. 13, 1859, No. 2,828. In the present improvements they maintain the principle thus laid down, but greatly simplify and improve the machine. 1, By connecting the second with the first machine by a continuous instead of a moveable tube, thus obviating the necessity of the type being touched in its transit from one to the other. 2, By placing the cutters for planing the dressed sides of the type horizontally instead of vertically, and in a line with and behind those for cutting out the foot, and by passing the type through the line of cutters thus arranged, so that the type has not to return, but is carried gradually past such cutters. 3, By placing the composing-stick in a line with and behind the above arrangement of cutters, so that the type is set up by the same motion which drives it through the cutters. 4, They also greatly facilitate the adjustment of the machine in changing from one body to another, by placing several parts of the machine upon packing pieces of the exact size of the body, by simply changing which the machinery is at once adjusted for that body. 5, They also render the machine easily adjustable for the different sorts of a fount, by making the letters themselves act as packing pieces for the separating of the two parts of the tube through which the type passes, and for defining the position of the sliding side of the table carrying the upright side of the tube and first cutter. 6, They have also facilitated the setting of the machine by making the cutters used for planing the rubbed sides adjustable in a horizontal and in a vertical plane, so as to ensure a flat cut upon the type. 7, In some modifications the type may be stationary, and the cutters moveable while the adjustment is effected, and the type held square by similar types in line on each side of it, instead of by grippers as in the before-mentioned invention. *Patent completed.*

2515. J. Bower. *Improvements in railway sleepers.* Dated September 12, 1862.

This relates to certain new forms and descriptions of cross sleepers for use on railways and tramways, which the inventor proposes to make of wrought or cast iron, or other suitable metal, of any length, and to be in cross section (trough like) and of a rectangular, triangular, curved, or angled V form, or of a section compounded of two or more of these forms. These sleepers are further provided with flat flanges or bearing surfaces projecting at the top edges, and drilled or bored for rivets or screw bolts, by which passing through these holes and through corresponding holes in the range flange the sleeper and rail are securely fixed to each other. In the case of the "double-headed rail," the flanges of the sleeper are fixed by like means to chairs carrying the rails, and bearing on both flanges of the sleepers. The convex or lower external part of the sleeper is intended to rest on the ballast in the usual way. The upper surface of the sleeper or its flanges may be recessed or grooved for the reception of the rail, or chair carrying the rail, to secure the gauge of the line; or the sleeper may be manufactured and used without such recesses. *Patent abandoned.*

2516. J. Rowell. *Improvements in pillars and apparatus for straining wire.* Dated September 12, 1862.

The details of this invention are too voluminous to be quoted here. *Patent completed.*

2517. J. Howie. *Improvements in the construction of the crossings and switches of railways.* Dated September 12, 1862.

Under one modification or system of arrangement embodied in this invention, in place of laying down rails of the ordinary kind 14 or 15 ft. in length, short lengths of rail are inserted in the main and siding rails at the parts which are found to wear away most rapidly by the traffic of the carriages. The parts which are found to give way so much sooner than the other portions of the line are those which are contiguous to the tongue or point rails; at these parts a comparatively short length of rail is interposed in the line of the ordinary rails, and forming a continuation of the same. These short lengths of rails are, by preference, formed of steel or case-hardened iron, in order that they may wear as long, or nearly as long, as the rails which are subjected to the ordinary wear and tear of the line. These short lengths of rail are fastened by means of fish-plates extending for some distance beyond the abutting ends of the rails, and are firmly bolted together. A portion of the bolts may be passed through both the rails, so as to obtain a very firm junction, and prevent all rocking or lateral motion of the rails; the fastening of the parts may, however, be effected in various other ways. In conjunction with these short lengths of hard metal rails it is proposed to make the extremities of the tongue rails, extending backwards a length of 4 or 5 ft., by preference, of steel or of case-hardened iron, so that these parts may wear in unison with the contiguous hard metal rails. *Patent abandoned.*

2518. A. J. Moreau. *An improved mode of or process for reducing or melting pulverized metals or metallic ores.* Dated September 12, 1862.

The iron sand or pulverized metal to be operated upon may be operated upon alone, or mixed in various proportions with metallic filings or turnings, so as to render the metal softer. These filings and turnings have the advantage of being homogeneous and of melting with the iron sand at the same temperature and in the same time as they are intimately mixed in the same block. In order to effect this reduction, the patentee first mixes the metal when in a finely divided state with a quantity of turnings and filings, the proportions of which may vary according to the degree of softness of metal it may be desired to produce. This mixture of the iron sand with filings or turnings having been effected, he incorporates these matters with some combustible matter in a plastic state, so as to dispense with the use of any other fuel. For this purpose he prefers peat, the heat of which is the most intense and the most regular; this substance also produces during the process a very dry gas in great abundance—that is to say, a hydrogen gas of very great calorific power. If peat is not to be obtained with facility, he takes small coal, or pulverized charcoal, or coke, and incorporates all these matters with a suitable proportion of peat in a damp state, and he forms the whole into a homogeneous and compact mass, which should be triturated and moulded into bricks or cakes of any convenient form and size, and which, on being exposed to the air or dried in ovens, will become as hard as stone. The bricks or cakes thus composed of ore, or metal, and fuel, when dried are ready to be operated upon, for which purpose they are to be thrown into the mouth of the furnace, and by reason of their form spaces will be left between them, thus leaving free passage upwards for the flame from the fuel and gases below. *Patent completed.*

2519. H. Higgins. *Improvements in machinery or apparatus for opening, cleansing, or carding cotton, and other fibrous materials.* Dated September 12, 1862.

The object of the first part of this invention is to work and clean the fibrous material by means of a series of card rollers, and to remove it at the end of such series in a loose form by means of a brush or other suitable agent, so as to collect it upon a cage and form a lap. The invention also consists in using a series of rollers, as aforesaid, in combination with beaters which act upon the material as in the usual scutcher. Another part of the invention relates to the machine usually termed the carding engine, and consists in the application of two or more "lickers-in" placed one before the other, revolving in the same direction, and acting as mutual workers, and in combination also with a roller or rollers situated between them. Another part of the invention relates to carding rollers or cylinders, and consists in the application of a collar or equivalent part of such a diameter as to prevent the rollers or cylinders to be set too near to each other. *Patent completed.*

2520. G. Bedson. *Improvements in rolling wire and other rods or bars of metal.* Dated September 12, 1862.

This invention consists in applying rolls to a furnace in such manner that they may draw the heated metal from it or through it, so that the operations of heating and rolling are performed simultaneously. *Patent completed.*

2521. W. Harkes. *Improvements in machinery for mowing and reaping.* Dated September 13, 1862.

This invention consists—1, In placing the cutters in a line with the axis of the driving wheel, instead of placing them either before or behind, as now customary; this position allows the cutters to follow the inequalities of the ground. 2, In connecting the shafts for the horse and the seat for the driver to a swivel frame connected to a centre stud in the main frame of the machine, for enabling the machine to be worked alternately to and fro across the field. 3, In making the cutters with knife edges at each edge of the blade, and in making the guides through which the cutters work to project on both sides of the blade; also in making the outside guide piece to swivel on a centre to provide for the alternate to and fro working of the machine. 4, In supporting the cutters in a frame, which frame is acted upon when required by a treadle and lever from both ends of the machine, to enable the driver to raise or lower the cutters at pleasure. *Patent abandoned.*

2522. H. J. Lewis. *Improvements in engines to be worked by means of water.* Dated September 13, 1862.

This invention relates to an arrangement of engine whereby the pressure of water from ordinary water works, or any other head of water, is made available to produce reciprocating motion in a piston, which motion is converted into continuous rotary motion by means of a connecting rod and crank, as in the ordinary steam engine. *Patent completed.*

2523. M. Chadwick. *Improvements in machinery for doubling, folding, or plaiting cloth or other woven fabrics.* Dated September 13, 1862.

This invention consists—1, in the application of moveable cross rails or wedges, instead of cards in the old plaiting machine. The rails or wedges in the action of the knife and cloth raise, and at each return of the knife the rail falls and presses against the cloth in the form of a wedge, and so secures the material. 2, The inventor gives the oscillating motion to the knife by means of an eccentric placed on the crank; this eccentric is fixed to a rod connected to a lever, which is placed on the knife shaft; in the action of the crank the eccentric will give a to and fro motion to the rod and lever, and thus give the required oscillating motion to the knife. *Patent abandoned.*

2524. W. J. Williams. *Improved apparatus or machinery for punching, cutting, or pressing metal or other plates or substances, which said improvements are also applicable to tension rods.* Dated September 13, 1862.

This invention consists in forming or constructing a machine for punching or piercing metal or other substances by manual power, that is to say—1, the patentee forms the frame of the machine of weight and thickness adapted to the purpose for which it is to be employed. On one end of this frame is the ordinary die or punching bolster to receive the punch tool or die, and above this, at a suitable distance, is a hollow neck shank or boss, having a thread cut in it; within this works a hollow spindle or shaft, with an external and similar thread cut in its extremity. This shaft is actuated by a lever of any convenient length, and is prolonged so as to allow of it being screwed to the bottom of the boss, shank, or neck before mentioned. Within this spindle or shaft is another spindle or shaft, also with a thread cut upon its exterior, and working in a corresponding thread in the inside of the first-mentioned one, and extending through the boss, one extremity carrying the punch, and the other end being carried up through the hollow spindle which serves as a guide for it. The thread on this last-mentioned spindle is formed with a slight difference in the pitch, though the course of the thread runs in the same direction. Thus, when the spindle or shaft first-mentioned has arrived at the bottom of the screwed boss, say a distance of several inches, this inner spindle will be advanced a very small distance; in practice, this distance would be about a quarter of an inch. By this means, he gains an enormous power, and can easily punch any-sized holes in ordinary boiler and other plates by very little exertion, though the action is necessarily very slow. Having broken the hole almost through, he turns the handle connected with the inner screwed spindle or shaft, which forces the punch or tool through the metal, cutting a clean and distinct hole. *Patent abandoned.*

2525. T. W. Cowan. *Improvements in the construction of portable or fixed pumps.* Dated September 13, 1862.

This invention relates to an improved method of constructing force and other pumps by means of the introduction of four pistons or valves with a double-barrelled pump. The apparatus consists of two barrels parallel to each other, each barrel having a double-action within itself. On the piston or valve rod in one barrel the valve acts so as to draw the water or other liquid. The leather or other material forming the valve is placed on the upper side of the piston, the other and lower piston in the same barrel having its valve or flap on the under side. The arrangement is reversed in the other barrel, the upper piston having the valve on its under side, and the lower one having the valve on its upper face. By this arrangement two pistons will be sucking or drawing in the water or other liquid, and the other two forcing it out. On one of the valve rods is placed an air vessel which moves with the valve rod and within the barrel. *Patent completed.*

2526. A. V. Newton. *An improved mode of and apparatus for sleeking, creasing, and raising leather.* (A communication.) Dated September 13, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2527. H. Bennett. *Improvements in machinery or apparatus for the rolling of wire rods.* Dated September 13, 1862.

This invention consists in arranging a pipe or conductor of cast or wrought iron or other metal (or when necessary a series of pipes or conductors), so that upon the iron or other metal being entered in one groove or hole of the rolls, the said pipe or conductor will act so as to conduct the wire into another groove or hole, and so on by using several conductors from one groove or hole to another until the piece or rod of iron or metal to be rolled is in several grooves or holes at once. As the iron or other metal comes from between the rolls rather flat, it has to be placed in the next groove or hole edgewise; therefore the patentee constructs the said pipe or conductor so that, although the iron or metal may enter flatways, it may come out edgeways at the other end, and be conducted in its proper form into the next hole or groove. These pipes or conductors may be fastened to a moveable carriage or traversing arrangement, so that the pipes or conductors may be drawn back when required to prevent the iron or metal accumulating between the delivery-hole or groove and that receiving it. By this invention each hank or rod of iron or metal may be rolled much longer than at present without deteriorating its quality. *Patent completed.*

2528. W. Palmer. *Improvements in lamps and in apparatus used therewith.* Dated September 23, 1862.

These improvements are applicable in constructing lamps wherein the burning fluid is forced up to the wick, and wherein the excess of fluid thus raised is allowed to flow away from the wick through openings near the upper part of the outer wick tubes. In these descriptions of lamps it has been found that, when hydro-carbons are used as burning fluid, they are liable to be driven out in conjunction with streams of atmospheric air to become ignited. Now these improvements in such description of lamps consist in applying to such holes and passages finely woven wire, or other fabric or material, so as to cause the fluid and air to be as it were filtered or prevented spurting out in a manner to become ignited. In order to fill such lamps, a valve is used, on the upper part of which is formed a neck with a hole or opening between it and the vessel, so that the fluid may flow into the neck when the vessel is tilted; and at or near the lower part of the neck is an outlet with a rising spout in order to admit of the fluid being poured from the lower part of the neck into the lamp; a valve is used to close the hole or passage between the vessel and the neck, and this valve is carried by a cylinder having a screw thread around it, which fits a corresponding female screw on the interior or the neck, so that by turning the inner cylinder the valve is moved away from its seat. *Patent abandoned.*

2529. E. G. Chant. *Improvements in self-binding portfolios or holders for newspapers, music, documents, letters, and other papers, or for woven or other fabrics or articles* *which it may be desired to bind or hold together.* Dated September 15, 1862.

This invention has reference to clipping and securing the papers and other articles by the aid of the back or folding or hinged portion of the portfolio or holder, and consists in effecting the clipping and securing by means of cords, strings, or equivalents, or strings passing from one leaf or side of the portfolio or holder to the other leaf or side, and by loops, eyes, or guides for the cords or strings on and at or near the back of one or both of the leaves or holders, and by spring compensations on and at or near the back of one or both of the leaves or holders, to compensate for the varying thickness or quantity of the articles to be bound or held together, as the same may be severally added from time to time. *Patent completed.*

2530. W. G. Rawbone. *Improvements in gun barrels, &c.* Dated September 15, 1862.

These improvements in gun barrels consists—1, in making a night and day line on the barrels, that is, a line upon the middle of the top of the barrel, or upon the top of the rib of the barrel, the line being bright while the other parts are dark. The reflection of the light upon the bright line assists in obtaining an accurate aim. The improvements in gun barrels consists, 2, in making a longitudinal undercut dovetail groove in the flat rib of the said barrels, in which dovetail groove the traversing sight of the firearm is made to slide, instead of making the said sight work in grooves cutting the edges of the said rib. *Patent completed.*

2531. J. Pender. *Improvements in hoops for fastening bales.* Dated September 15, 1862.

This consists in making hoops with one or more elongated holes at one end, and one or more circular holes at the other end, for containing rivets, studs, or buttons. One part of each elongated hole is sufficiently large to allow the head of the rivet, stud, or button to pass through, and the other, or narrow part, is of such a size as to allow the neck or shank to pass, but not the head. For punching the holes in the band of hoop iron, the patentee uses a punching and cutting machine with punches and dies of the size and shape of the holes to be punched, and curved or straight cutters for cutting the ends of the hoops, so that the machine will cut each hoop at one or both ends at the same time as the holes are punched. *Patent completed.*

2532. E. Balurforth. *Improvements in machinery employed in finishing textile fabrics, commonly called "raising gigs."* Dated September 15, 1862.

This invention consists in the application to raising gigs of a cylindrical brush placed in contact with the teasels on the swift, to which rotary motion is given at a greater surface speed than the surface speed of the said swift, and in the direction of rotation thereof, by which means the flocks and dirt are constantly removed and prevented from accumulating on the teasels during the time the machine is in operation, thus avoiding the frequent stoppage of the machine for the purpose of cleansing the teasels, as heretofore. *Patent completed.*

2533. W. L. Tizard. *Improvements in the construction of ships, vessels, cupolas, and forts, and in apparatus employed therein.* Dated September 15, 1862.

This invention was described and illustrated at page 26 (No. 200), of this journal. *Patent completed.*

2534. H. M. Radloff. *An improvement in vessels for filtering oils.* Dated September 15, 1862.

Hitherto oils have been filtered in vessels with plain sides, in which a filtering body has been compressed and held between two perforated plates, the oil being filtered by ascension. From the sides having been plain, instead of the whole of the oil passing up through the filtering body, a portion has found its way between the filtering body and the plain sides of the vessels. Now this invention consists in forming the filtering vessels in two parts, the upper part carrying a flange fitting inside the other part, and resting upon the edge of the upper perforated plate. The patentee also forms a ledge inside the under part, upon which the upper perforated plate rests. No portion of the oil can pass except through the filtering body. *Patent completed.*

2535. J. Webster. *Improvements in the manufacture of nitric and nitrous acids, and other nitrogenous compounds.* Dated September 15, 1862.

In carrying out this invention, the patentee first generates the binoxide of nitrogen gas from nitrous acid, or any other body containing the binoxide of nitrogen gas. If using nitrous acid, he causes the acid to be run into a suitable retort or vessel red hot, and filled with pumice stone, or other similar material that will stand a red heat without being decomposed by the acid. The nitrous acid being run or dropped upon the red hot pumice stone becomes converted into binoxide or dentoxide of nitrogen gas NO^2. This gas is then conveyed to a vessel or generator, or condenser, furnished at a suitable position at the side and near the bottom with a draught hole or regulating damper, and at the top with an outlet into a chimney to obtain a draught; or the draught may be insured by other means if required. One or more of these generators or condensers may be employed according to circumstances. The binoxide of nitrogen gas NO^2 may be conveyed to the generator from the retort by a pipe having its ingress to the generator at or near the bottom of that vessel, and opposite the draught pipe, to meet the current of air passing through the draught pipe. The binoxide of nitrogen gas NO^2, coming into contact with the air, instantly absorbs two of oxygen from the atmosphere, and becomes nitrous gas NO^4. The generator contains a number of trays or divisions upon which are laid the following materials (varying according to circumstances): thus, if he requires to make nitric acid and nitrous acid, the materials upon the trays will be gravel, sand, broken pumice stone, or other similar substances, upon which the acid will not act damped with water. If he requires to make any particular nitrate, he places upon the trays, instead of the substances before-named, the caustic base of such nitrate damped with water; thus, if he wishes to make the nitrate of potass, he employs the caustic of potass; if the nitrate of soda, the caustic of soda; and so on; only in the case of using caustic of soda, care must be taken that it be mixed with gravel or sand to prevent its offering by its density any obstruction to the passage of the gas, and to afford a larger surface for the action of the gas. Carbonates, either alone or mixed with the caustics, may also be employed if preferred. *Patent completed.*

2536. E. Astel. *Improvements in urinary utensils, also applicable to fixed and portable commodes.* Dated September 16, 1862.

This invention is not described apart from the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Feb. 20, 1863.

468. W. Clark, 53, Chancery-lane, engineer. Improvements in projectiles for ordnance. (A communication.)

Dated Feb. 27, 1863.

551. H. Fehr, merchant and distiller, 63, Fenchurch-street. Improvements in the treatment of mineral oils.

Dated March 5, 1863.

629. J. Elsey, Nottingham, lace manufacturer. Improved apparatus for the winding of lace on to the work roller in warp lace, bobbin net, or twist lace machines.

Dated March 9, 1863.

645. H. Whittles, Milnrow, Lancaster, engineer. Improvements in machinery or apparatus for collecting the condensed steam or waste water from places where steam is used, and returning the same to the boiler.

647. J. Cowley, Oxford, engineer. Improvements in machinery or apparatus for manufacturing bricks, tiles, pipes, and mouldings.

649. J. Isherwood, Sharples, near Bolton, yarn bleacher. Improvements in working presses for making up yarn in bundles.

651. C. H. Lea, Shallowford, near Stone, Stafford, miller. Improved apparatus for opening and closing the gates of railway crossings, which apparatus also acts simultaneously upon the signals.

653. P. Hugon, 56, Rue de l'Ouest, Paris, civil engineer. Improved machinery for obtaining and applying motive power.

657. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the construction or laying of wooden floors. (A communication.)

Dated March 11, 1863.

661. F. Cooke, Denton, Lancaster, hat manufacturer. Certain improvements in the manufacture of hats or coverings for the head.

663. J. Cassell, La Belle Sauvage-yard, publisher. Improvements in moderator lamps to adapt them to the burning of petroleum and other mineral oils and hydro-carbons. (A communication.)

665. W. R. Mulley, Plymouth, surveyor to Lloyd's Register. Improvements in sheathing iron ships, caissons, and other like structures.

671. J. Tomlinson, Roach Iron Works, Rochdale, machinist. Improvements in machinery for opening twisted yarns and woven fabrics.

673. W. Rossetter, Accrington, mechanic. Improvements in back beam warping machines.

Dated March 12, 1863.

675. H. D. and J. W. Taylor, Huddersfield. Improvements in finishing woollen, worsted, and other fabrics, and in machinery or apparatus to be used therein.

676. L. Dessens, 45, Boulevart Bonne Nouvelle, Paris, gentleman. An improved bath, or bathing machine, adapted for deep water.

677. W. Clark, 53, Chancery-lane, engineer. Improvements in breech-loading firearms. (A communication.)

679. J. Polkinghorne, Redruth, Cornwall, tin smelter. Improvements in treating tin ores, and in apparatus for treating ores and matters containing arsenic.

Dated March 13, 1862.

681. J. Harris, Pontypool, Monmouth, iron plate roller, J. Butler, Pontypool, iron manufacturer, and J. H. Fraser, Llanvrechva Upper, Monmouth, manufacturer. Improvements in machinery for rolling armour plates, bridge plates, boat plates, and other plates and bars of iron.

683. J. Taylor, Burnley, cotton spinner. Improvements in fire bars and bearers.

685. W. H. Stübbe, New York. Improvements in governors for marine and other engines.

687. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in fastenings suitable for portions of harness and other purposes. (A communication.)

Dated March 14, 1863.

689. W. E. Gedge, 11, Wellington-street, Strand. An improved plough. (A communication.)

691. W. West, Treadenham House, St. Blazey, Cornwall, civil engineer. Improvements in valves.

693. J. W. McCarter, The Foyle-street Sawmills, Londonderry. Improvements in machinery for sawing or cutting wood.

699. J. Walworth, Bradford, corn mill machine maker. Improvements in machinery or apparatus for washing or cleansing and drying Egyptian wheat, beans, and other kinds of grain or seeds.

Dated March 16, 1863.

701. E. Oliver, engineer, and G. Myers, draughtsman, Rotherham. Improvements in apparatus for lowering and disengaging boats from vessels.

702. F. Hoyos, 42, Rue de Chaillot, Paris, manufacturer. An improved stove or fire-grate for heating, cooking, boiling, or other similar purposes.

703. T. W. Willett, 31, Charing-cross, captain. Improvements in means for reefing and furling square sails of ships and vessels from the decks thereof.

705. G. P. Beley, Liverpool, merchant. Improvements in discharging projectiles below the water line of navigable vessels and other structures.

709. W. G. Eavestaff, Great Russell-street, pianoforte manufacturer. Improvements in the construction of pianofortes.

Dated March 17, 1863.

713. W. E. Gedge, 11, Wellington-street, Strand. Improvements in the modes or means for framing pictures, looking glasses, and other objects. (A communication.)

714. W. H. Emett, 8, St. George's-terrace, South Kensington, lithographer. Improvements in processes for facilitating and combining the art of writing with engraving together on stone, applicable to maps, plans, specifications, and other lithography, which improvements are also available for retransfers to zinc or stone, or printing from original.

717. G. De Laire, Imperial Mint, Paris, chemist. Improvements in the manufacture of brown colouring matters. (Partly a communication.)

719. W. Symington, Market Harborough. Improvements in the process of, and apparatus used in, roasting and treating coffee and other organic substances.

720. W. C. Wild and J. H. Randel, Birmingham, dealers in precious stones. A new and improved mode of inlaying gold and other metals in glass, and in a composition suitable for the manufacture of jewellery and other ornaments, buttons, and other similar articles.

721. W. Donbavand, Manchester, scale beam and weighing machine manufacturer, and D. Critchton, machinist. Improvements in looms for weaving.

722. J. Roberts, Manchester, organ builder, and R. Naylor, gentleman. Improvements in organs, harmoniums, and pianofortes.

723. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the manufacture of spoons and forks. (A communication.)

725. W. E. Taylor, Enfield, near Accrington, Lancaster, cotton spinner and manufacturer. Certain improvements in machinery for reeling, winding, warping, and beaming yarn.

729. T. Oldknow, Ashforth's Factory, Nottingham, general machinist. Improvements in the construction of jacquards employed in bobbin net or twist lace machines.

732. A. Morel, Rue du Marché, Brussels, engineer. Improvements in apparatus for generating carbonic acid.

733. J. D. and A. P. Welch, Gutter-lane, straw hat manufacturers. Improvements in bleaching, and in reducing and brightening the colour or tone of dyed straw plaits and straw.

Dated March 19, 1863.

735. E. Lever, Manchester, manufacturer of colliery brattice cloth and flexible tubing. An improved composition for the coating and preservation of canvas and other materials to make them waterproof and non-inflammable.

741. G. H. Smith, Ipswich, machinist. Improvements in sewing machines.

Dated March 20, 1863.

744. A. Barclay and A. Morton, engineers, Kilmarnock. Improvements in certain apparatus for injecting and ejecting fluids.

745. J. Nield, iron founder, and T. A. Nield, engineer, Dukinfield. Improvements in core barrels.

746. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in machinery for beating and drying wool and other textile and filamentous substances. (A communication.)

748. G. Wilson, Cyclops Steel and Iron Works, Sheffield, engineer. An improvement in the manufacture of springs.

749. G. Coles, Gresham-street West, merchant, J. A. Jaques, chemist, and J. A. Fanshawe, engineer, Tottenham. Improvements in machines or apparatus for washing or wringing clothes or fabrics.

750. C. Pryse, Birmingham, manufacturer, and D. Kirkwood, gun maker. Improvements in breech-loading firearms, part of which improvements are also applicable to other descriptions of firearms.

752. F. De Wyldé, Trinity-square, Tower-hill. Improvements in the manufacture of cement from gypsum.

Dated March 21, 1863.

754. F. and A. Roberts, 5, Victoria-cottages, Barton-terrace, Gloucester. Improvements in agricultural implements, and in apparatus for working the same.

755. C. De Groote, Brussels, shorthand writer. Improvements in the construction of lamps with circular burners, or wicks for the combustion of petroleum, schist, and other volatile oils, parts of said improvements being applicable to gas burners, night lights, and lamps burning spirits and animal oils.

760. F. Applegate, Bradford-on-Avon, woollen manufacturer. Improvements in time indicators.

Dated March 23, 1863.

764. W. Johnston, Glasgow, metal merchant. Improvements in apparatus for lighting and heating.

766. J. Eyles, George-street, Portman-square, milliner and dress maker. Improvements in cheffonier bedsteads.

Dated March 24, 1863.

770. G. Davies, 1, Serle-street, Lincoln's-inn. Improvements in wrappers or papers for needles, and in machinery or apparatus for sticking needles therein. (A communication.)

772. H. Williams, Portmadoc, Carnarvon, engineer. Improvements in machinery or apparatus for dressing slates.

774. J. Kirkham, Euston-road, civil engineer. Improvements in the manufacture of iron and steel.

Dated March 25, 1863.

776. J. White, Finchley, surgeon. Improvements in protecting the surface of the iron and steel of ships and all other structures, except that of cables, tanks, and boilers, while in contact with water, from decay; in preventing or abating, and in facilitating the removal of foulness of ships' bottoms; and in giving a capacity of increased speed to ships.

778. J. Leach, cotton spinner, and J. Anderson, manager, Ashton-under-Lyne. Certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.

780. **G. Stuart, Glasgow, commission merchant.** Improvements in bleaching jute fibre.

782. **R. Armitage, Huddersfield, and C. Senior, Dead Waters, near Huddersfield, engineers.** Improvements in means or apparatus for stretching fabrics.

784. **T. W. Gore, New Whittington, Derby, builder.** An improved method of uniting earthenware, metal, and other pipes.

Dated March 26, 1863.

788. **R. Mushet, Coleford, metallurgist.** An improvement or improvements in treating steel and iron prepared by the pneumatic process.

792. **W. Johnson, Warwick-square, manufacturer.** Improvements in pocket books, purses, wallets, and bill cases.

794. **W. Tod and R. Paterson, Glasgow, engineers.** Improvements in portable apparatus for working drills, and other instruments.

796. **J. H. Johnson, 47, Lincoln's-inn-fields, gentleman.** Improvements in furnaces or fire-places, and in apparatus to be used in connection therewith. (A communication.)

798. **W. Blake, Glasgow, manufacturing stationer.** Improvements in the manufacture of labels for luggage and other articles.

800. **E. Easton, The Grove, Southwark, engineer.** An improved application of hydraulic apparatus for lowering full casks and other goods, and raising empty casks or vessels.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated March 25, 1863.

786. **G. T. Key, Lieutenant, Portsmouth.** Improvements in fog and other signals.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, March 31, 1863.

2806. **W. S. Kennedy.** Apparatus for applying fomentations and other external remedies to the throat.

3167. **T. M. Elton.** Manufacture of soap.

3170. J. Steinthal. Moulder's blacking.

3171. F. Palling. Fountain penholder.

3173. W. Austin. Cartridge cases.

3176. J. Halford. Preparation and treatment of small coal or slack, whereby a certain carbonaceous product is obtained and rendered available for use in the manufacture of iron and steel in the processes of casting and moulding metals, and in the manufacture of paint and such like articles.

3178. F. W. Hartley. Obtaining certain products resulting from the manufacture and purification of coal gas. (A communication.)

3181. D. and D. Auld, jun. Working furnaces and steam-boilers.

3182. J. L. Linton. Means of generating steam. (A communication.)

3183. D. Veerkamp and C. F. A. Van Trigt. Treatment of old manufactured fabrics.

3189. J. H. Johnson. Apparatus for indicating the pressure of electric conductors in foreign bodies. (A communication.)

3192. S. J. Browning. Machines to be employed in brewing.

3200. F. G. Taylor. Washing machines.

3207. Rev. H. Moule. Locomotive engines.

3211. M. Henry. Manufacture of leather. (A communication.)

3214. G. F. Griffin. Permanent way of railways.

3216. J. Irwin. Machine for cultivating land.

3217. R. Fiude. Looms.

3221. P. W. Reuter. New compound to be used for dyeing and printing purposes. (A communication.)

3230. G. F. Blumberg. Method of, and apparatus for, producing designs in or on glass.

3235. D. Graham. Steering and manœuvring ships or vessels.

3258. R. Wallis. Apparatus for loading and unloading vessels.

3262. L. Christoph, W. Hawksworth, and G. P. Harding. Drilling, drawing, and rolling metals.

3283. R. A. Brooman. Kneading machines. (A communication.)

3294. J. H. Johnson. Steam generat s. (A communication.)

3315. W. Clark. Umbrellas. (A communication.)

3359. W. and A. Smedley. Manufacture of textile or looped fabrics on warp lace machines.

3397. W. S. Longridge. Machinery for rolling tyres, hoops, and rings.

3400. A. V. Newton. Machinery for attaching metal eyelets to cloth and other materials. (A communication.)

3453. C. F. Varley. Electric telegraphs.

307. W. G. Valentin and F. Levick. Generating combustible gases.

349. J. James. Covering for hooped skirts.

529. W. E. Newton. Stereotype plates for printing purposes. (A communication.)

532. J. Inglis. Apparatus for folding paper and other fabrics or materials.

569. D. Collinge. Apparatus for cleaning, steaming, and preparing cotton or other fibrous materials to be spun.

587. G. Haseltine. Sewing machines. (A communication.)

594. G. Price and W. Dawes. Burglar-proof safes and strong-room doors and frames.

658. J. H. Johnson. Treatment of certain fibrous vegetable substances with a view to the production of textile materials therefrom. (A communication.)

661. F. Cooke. Manufacture of hats or coverings for the head.

680. H. B. Barlow. Looms for weaving. (A communication.)

736. H. Wilde. Construction of steam boilers.

738. J. Saunders and J. Piper. Apparatus employed in the manufacture of tin and terne plates.

754. F. and A. Roberts. Agricultural implements.

778. J. Leach and J. Anderson. Preparing and spinning cotton and other fibrous substances.

780. G. Stuart. Bleaching jute fibres.

786. G. T. Key. Fog and other signals.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed April 6, 1863.

2698. J. Newnam.
2699. T. Beards.
2708. A. Forbes.
2710. H. D. P. Cunningham.
2711. J. K. Hampshire.
2712. J. and M. A. Beale.
2714. C. F. Terry.
2728. A. V. Newton.
2731. L. Hosch.
2733. R. E. Green and J. Cockcroft.
2738. D. S. Sutherland.
2739. E. Weallens.
2741. J. J. Shedlock.
2743. A. Vennedy.
2744. R. A. Brooman.
2746. J. Durrant.
2748. A. V. Newton.
2758. J. Gumbley.
2760. E. B. Wilson.
2765. E. Barlow, J. Clough, and F. Hamilton.
2781. C. de Bergue.
2784. J. B. G. M. F. Piret.
2790. W. Barningham.
2808. J. H. Johnson.
2812. J. Bentley.
2317. W. Clark.
2855. W. Clark.
2877. W. Clark.
2894. A. Peek.
2940. W. E. Newton.
2950. F. E. Sickels.
2952. W. Jenkins.
3046. C. Socin.
3166. W. Longley.
3275. A. V. Newton.
3234. G. T. Bousfield.
3483. F. Applegate.
67. L. Hull.
119. G. T. Bousfield.
155. G. T. Bousfield.
208. E. Straugman.
225. F. Tolhausen.
285. J. Mackenzie.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

861. T. Ingram.
886. J. Hamer.
891. T. Aveling.
896. E. Heywood.
921. O. Vandenburgh.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

812. A. Morton.
813. W. Terry.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending April 4, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2361	0	8	2370	1	6	2379	0	10	2388	0	4	2397	0	4	2405	0	8
2362	1	0	2371	1	0	2380	0	6	2389	1	2	2398	0	6	2406	0	6
2363	0	8	2372	0	4	2381	0	6	2390	1	4	2399	0	4	2407	1	8
2364	0	8	2373	0	8	2382	0	10	2391	0	8	2400	0	10	2408	0	8
2365	0	10	2374	0	10	2383	0	4	2392	0	4	2401	4	2	2409	0	8
2366	0	4	2375	0	10	2384	0	10	2393	0	4	2402	0	10	2410	0	4
2367	0	4	2376	0	4	2385	0	4	2394	0	4	2403	0	4	2411	2	0
2368	0	4	2377	0	4	2386	0	8	2395	1	2	2404	0	10			
2369	0	4	2378	0	4	2387	0	10	2396	0	8						

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback, 1s.

		£	s.	£	s.
Teak	load	14	0	15	0
Quebec, red pine		3	10	4	10
,, yellow pine		3	0	4	0
St. John, N.B., yellow		5	0	5	10
Quebec oak, white		5	10	6	10
,, birch		3	0	3	10
,, elm		3	10	5	0
Dantzic, oak		3	10	6	10
,, fir		2	10	3	10
Memel, fir		3	0	3	5
Riga		3	0	3	5
Swedish		2	10	2	15
Masts, Quebec red pine		5	0	6	0
,, yellow pine		5	0	6	0
Lathwood, Dantzig, fm.		5	10	6	10
,, St. Petersburg		8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					
Quebec, white spruce		15	10	19	10
St. John, white spruce		14	10	16	10
Yellow pine, per reduced C.					
Canada, 1st quality		17	0	18	0
,, 2nd do		11	0	12	0
Archangel, yellow		13	0	13	10
St. Petersburg, yellow		11	10	12	0
Finlan		9	0	10	0
Memel		10	0	15	0
Gothenburg, yellow		10	0	11	0
,, white		9	0	9	10
Gefle, yellow		10	0	11	10
Soderhamn		9	10	10	10
Christiania, per C., 12 ft. by 3 by 9 in. ,, yellow		21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.		0	14	1	4
PUMICE STONE. per ton		5	10	9	0

OILS, &c.

		£	s.	£	s.
Seal, pale	per tun	48	0	0	0
Sperm body		82	0	82	10
Cod		47	10	48	0
Whale, South Sea, pale		48	0	0	0
Olive, Gallipoli		58	0	59	0
Cocoanut, Cochin		53	10	0	0
Palm, fine		38	0	0	0
Linseed		42	5	0	0
Rapeseed, English pale		53	0	0	0
Cottonseed		34	0	44	0

METALS.

		£	s.	d.		£	s.	d.	p.ct.
IRON:									
Welsh Bars, in London	per ton	6	10	0	to	6	15	0	2½
Nail Rods	,,	7	0	0	,,	7	10	0	,,
Hoops	,,	8	7	0	,,	8	10	0	,,
Sheets, single	,,	9	5	0	,,	9	10	0	,,
Staffordshire Bars	,,	7	10	0	,,	8	0	0	,,
Bars, in Wales	,,	5	10	0	,,	5	15	0	,,
Rails	,,	5	10	0	,,	5	15	0	nett
Foundry Pigs, at Glasgow, No. 1	,,	2	11	0	,,	2	17	6	,,
Swedish Bars	,,	11	5	0	,,	11	10	0	2½
STEEL:									
Swedish Keg, hammered	,,	16	0	0	,,	0	0	0	,,
,, Faggot	,,	17	0	0	,,	0	0	0	,,
COPPER:									
Sheet and Sheathing, and Bolts	,,	96	0	0	,,	0	0	0	3
Hammered Bottoms	,,	106	0	0	,,	0	0	0	,,
Flat Bottoms, not hammered	,,	101	0	0	,,	0	0	0	,,
Tough Cake and Ingot	,,	89	0	0	,,	0	0	0	,,
Tile Copper	,,	89	0	0	,,	0	0	0	,,
Best Selected	,,	92	0	0	,,	0	0	0	,,
Composition Sheathing Nails	per lb.	0	0	10	,,	0	0	0	,,
Yellow Metal Sheathing and Rods	,,	0	0	8½	,,	0	0	8½	,,
Fine Foreign	per ton	94	10	0	,,	95	0	0	3
TIN:									
English Block	pr cwt.	5	19	0	,,	0	0	0	2½
Bar	,,	6	0	0	,,	0	0	0	,,
Refined	,,	6	4	0	,,	0	0	0	,,
Banca	,,	6	9	0	,,	0	0	0	nett
Straits	,,	6	4	0	,,	6	5	0	,,
TIN PLATES:									
Best Charcoal, I.C.	pr box	1	8	6	,,	1	9	0	3
Second Quality	,,	1	6	6	,,	1	7	6	,,
Coke	,,	1	3	0	,,	1	4	0	,,
LEAD:									
Pig, English	per ton	20	15	0	,,	23	0	0	2½
Spanish, Soft	,,	20	5	0	,,	20	10	0	,,
Shot, Patent	,,	23	10	0	,,	24	0	0	,,
Sheet	,,	21	10	0	,,	21	15	0	,,
White	,,	26	1	0	,,	0	0	0	,,
SPELTER:									
On the spot	,,	17	7	0	,,	18	0	0	nett
ZINC:									
English Sheet	,,	23	10	0	,,	0	0	0	2½
QUICKSILVER	pr btl.	7	0	0	,,	0	0	0	3
REGULUS OF ANTIMONY:									
French Star	per ton	42	0	0	,,	0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, APRIL 17, 1863.

MARINE ENGINE IMPROVEMENTS.

Were we asked in what field steam-power offered the greatest rewards, and the most favourable opportunities for improvement, under certain limitations, we should answer without hesitation, on board ship—the situation of all others where reduction of weight, diminution of occupied space, and the utmost economy in the consumption of fuel, are called for. Many may think the subject of steam-engine economy hackneyed; to the theorist, who in his study elaborates theorems, and studies equations, until his eyes dim and his brain reels, the subject may well seem so; he may exclaim, "What more can be said or written on the question? it is exhausted;" but to the practical man the case is far different; to him, the subject must always prove interesting, because without it he cannot think to hold his own in the race now run by engineers, each striving after the prize, that prize a noble one, wealth and honour, and a place high amongst men, to him who can make the best and (shall we say "consequently?") sell the greatest number of engines. We do not mean to say that engineers exert themselves to improve steam machinery solely for money, or even for power. To many the work of improving is in truth a labour of love; and from the labour of such men, when untrammelled by existing circumstances, and possessed of a thorough practical knowledge of the actual requirements which are most conducive to success, we may expect the very happiest results; but, unfortunately, such men can rarely give scope to their inclinations. The moment the engineer sets foot on board ship he finds himself trammelled on every side; and to this cause, far more than to want of skill, knowledge, or inclination on his part, we attribute the admittedly very slow progress which steam-engine economy makes, not only in the Navy, but in the merchant service.

Most of our great engineering establishments are old ones, dating their origin far back, to those old days when steam was in its infancy; they have arrived at their present standing, not by a spontaneous growth, but by the unwearied exertions of able men—men whose dearly-bought experience is not to be overthrown by any array of calculations however tempting, and who refuse to listen to the voice of the mathematical charmer, "charm he never so wisely." How many obstacles have been overcome, how many disheartening failures contended with, what enormous sums of money spent, in gathering up that store of knowledge which has led to that success which constitutes the pride of our Maudslays and our Russells, our Penns and Watts—men to whom England is as much indebted for her naval supremacy as to Howe or Nelson! From such men we have received steam vessels second to none in the world, with engines which, although heavy and costly, and almost free from even a pretence to economy, are perfectly trustworthy, and justly esteemed in consequence. It is scarcely likely that such men will take the initiative in any further attempt at marine engine improvement; they more likely will rest, content with their well-earned laurels, and gazing serenely from the elevation which they have reached, say to younger firms, "Go thou and do likewise;" and to those engineers who have wealth and honour yet to obtain, we say that nowhere will they find opportunities for the attainment of both equal to those afforded by successful marine engine construction.

Coals at home at home are cheap; a few tons more or less per day are of little importance to wealthy companies; but how stands the matter when we get to foreign stations, where coals become black diamonds indeed, and the saving of fuel a matter of the most paramount importance? In such situations, we believe, few would not be content to sacrifice space in the ship, and even submit to an increase of weight in the engine, in order to keep down the consumption of fuel; how much more gladly then should we avail ourselves of such improvements as not only reduce the consumption of fuel, but also weight and space! That such improvements are within our grasp, are ready for our adoption, is certain; why then do we not avail ourselves of them to a greater extent than we do? For the same reason that the shepherd king refused to go in armour to contend with the Philistine, because "he had not proved it."

We have already said that the moment the engineer sets his foot on board ship, he finds himself trammelled on every side by considerations of available space, weight, first cost, power, &c.—nay, even when the engine-room is handed over to him by the shipbuilder, he cannot consider himself at liberty to use that space, limited as it is, as he pleases; considerations of "trim," as influencing the future seagoing qualities of the ship, must enter into all his dispositions and calculations; and thus, perfect as any general design may appear on paper, we commonly find such alterations necessary, to meet the different requirements of individual cases, that little more than the general principles which have guided the designer remain; all matters of detail become merged in the one consideration, "expediency." Thus we find that marine engines as a class make less progress in economics than any other; let us enter a little deeper into "the reason why," a question often asked, seldom satisfactorily answered.

Scarcely any class of engine has undergone the same amount of improvement as the locomotive; comparatively an infant in years, it shows all the science, culture, and physical development of the full-grown man. All the resources of science and the refinements of art have been lavished on it; always an attractive subject to mechanical minds, from its extreme beauty, its exquisite simplicity, and its vast concentration of power within the smallest limits, it has, perhaps, during the few years which have elapsed since the "Rocket" first astonished those who gazed on its till then unparalleled performance, received more attention than almost any other form of engine; its powers of bringing itself before the public have been unrivalled, and, therefore, it has met with world-wide attention. Elaborate treatises have been written on the minutest points connected with its *physique;* its anatomy studied with a skill worthy of a Hunter, or a Cooper, and as a result we have—the modern locomotive, a machine before which admiration becomes dumb, and even praise sinks into silence.

The great cause of this improvement has been the free scope hitherto allowed, to both the builder and designer, for the free exercise of their respective talents; certain restrictions and limitations, so trifling as scarcely to merit the name, complied with, they may follow the full bent of their inclinations and introduce such alterations as their experience may suggest as likely to prove not only alterations, but improvements.

In many cases we find, too, that, from the skill and attention of locomotive superintendents, particular classes of locomotives have derived certain peculiar advantages, which cause them to stand high in the opinions of the engineering public. Gifted, in most cases, with considerable attainments, and carefully trained in the practical routine of their professions, all such men required were the means and permission to carry out such experiments, and make such alterations as they considered would effect improvements. Directors willingly granted the permission, shareholders eagerly produced the pecuniary requirements necessary, and, as a consequence, locomotives of the most varied construction were turned out from the workshops all over the kingdom. Experiments could easily be entered into; no difficulty could possibly be experienced in trying a new engine, even although it was like nothing which had gone before, and involved the newest and strangest features; for risk was merely nominal, the cost of an engine seldom exceeding £2,000 or £3,000; so that, even if the machine proved an utter failure, and found its place in the scrap-heap instead of working the line, it was a matter of little consequence; no risk of life and limb, considerations far more important, being involved, it was just as safe to travel a hundred miles with such an engine as with one of the ordinary trains; indeed, we find that many of the most valuable results we possess have been obtained from experiments conducted with ordinary passenger trains in the usual course of business.

Ranking before the locomotive in economy, though second to it in importance, we have the Cornish engine—a machine which approaches nearer to theoretical perfection than almost any other which man's ingenuity has enabled him to construct. Here, again, we see the result of genius untrammelled by conditions, either dictated by circumstances, or, worse still, by a lay public. The designer, totally unfettered, devotes all the energies of his well-trained mind to the subject, and regarding the machine in the abstract, instead of the positive, brings it to such perfection that we find a consumption of a couple of pounds of coal per hour gives us a horse-power. How different in all respects is the history of the marine engine from either that of the locomotive or the Cornish; it is a history in which we find little but a constant war between theory and practice—a perpetual struggle, on the part of the engineer, to make that which was right expedient as well. The result has been a class of engines, heavy, bulky, and expensive, both to purchase and use, but possessing the one advantage, which, up to the present, at least, is considered to compensate for the want of every other, they are perfectly trustworthy.

No improvement in the marine engine is likely to meet with universal, or even partial, adoption until it has been thoroughly proved by a series of experiments, conducted on a great scale, by able men; until, in fact, the engine has undergone the same thorough examination as the locomotive, we regret that at present we see little chance of any great undertaking of the kind likely to lead to useful results. It is true that, in a few cases, we see engines embracing many novel features taken into favour, but such cases are too rare to influence the public mind to any considerable extent. Experiments assume a very grave aspect indeed when they are performed on a machine costing tens of thousands of pounds, and on the successful working of which depends, it may be, the lives of hundreds of our fellow-creatures. The breaking down of an engine, the leakage of a boiler, has, ere now, alas, too often carried desolation and misery to many an English home; rash, indeed, would be the man who could for a moment advise such a departure from precedent as would introduce a single element of extra risk on board a steamship; hence we find old plans and models of engine adhered to with a tenacity of gripe which the hand of science has hitherto proved too weak to unloose. Let us ask ourselves, how long can this state of things continue? and, supposing we are dissatisfied with it, to what quarter are we to look for an initiative in a change for the better? These questions are doubtless full of importance, and worthy of the most serious consideration, not only from the engineer, but also from the public at large.

The general practice amongst steam shipping owners is, when giving an order for an engine, to go to some first-class firm celebrated for the construction of the particular class of engine they may require; and this firm would no more depart from the ordinary style of engine on which their reputation rests than they would bore holes in the vessel and send her to the bottom. Indeed, the certainty is that any attempt at the introduction of a decided novelty would be as stoutly resisted by the owners as the actual scuttling of the ship. With all our desire to see science advance, we cannot but admit that such principles are correct in the case of ocean steam-ships. Certain forms of engine a long series of years have proved trustworthy, and the loss of the ship and all hands, or even a considerable delay on her voyage, would be badly compensated for by the saving of a few tons of coals, or the use of a smaller engine. Such steamers are quite unsuited for the first embodiment of a crude idea—crude, because untried. Nor does the Navy offer a much better field. Such ships would badly fulfil their purpose did they break down far from home, perhaps close on an enemy's shore; but, fortunately for the ends of science, all necessary opportunities are still afforded to the engineer by the large class of vessels which carry on our home trade, making short voyages from port to port. Such vessels can rarely encounter any risk comparable with the ocean steamer, and often belonging to companies, who give almost unlimited powers to their manager, who stands, indeed, in nearly the same relation to his employers that the locomotive superintendent does to the board of directors. In such situations, men of talent and enterprise can do much; and, although tied up in many respects, they have nevertheless every reasonable opportunity for experiment; the ships with which they have to deal are generally of moderate size, and making but short voyages little danger is run of a breakdown, which is very unlikely to happen, because the ship spends so much time in port that every opportunity is afforded for the most thorough examination of the machinery.

But, granting that we have thus a sufficiently numerous class of steamers on which to conduct experiments, in what should these experiments consist? We reply, in the first place, that, on board a steamer, an engine on a perfectly new and untried principle should never be made the subject of experiment. We have known such cases where the only result obtained by a really clever thing was loss of money, risk of the ship and crew, and the creation of such a disgust for anything new in the minds of all connected with the ship, as led to the engine's being ignominously removed, and replaced by machinery which could be depended on, although inferior in all other respects to that rejected. All such engines should be carefully tried on shore first, tried for many days in constant work; carefully tried afterwards when on board the ship on the regular trial ground. Many things will be found to require alteration and improvement, and the result will most probably be a vessel which will give perfect satisfaction.

In making use of the word "experiment," we do not mean the conducting of a series of observations in order to obtain certain information which we require relative to the working of any particular class of engine; we mean that every engine the construction of which involves any novelty of principle or working detail, is in its first use an experiment, and requires careful testing ere the lives of passengers, and the property of public companies are suffered to depend on its successful working.

The question only remains, to what quarter should we look for success? The answer is obvious; no further economy can be obtained in steam power without the use of high pressure and expansion. The theorist who proposes such schemes may find fault, and complain of the tardy adoption of his ideas; but he should remember the difficulties which beset the marine engineer in every attempt to make what is theoretically correct practically right also; that the possibility of doing so exists, is proved by the great comparative success which has already attended the labour of many of our junior firms; and we feel little doubt that from such men the subject of steam propulsion will meet with such sound attention as must, in the course of a few years, lead to improvements which will make the marine rank with either the Cornish or locomotive engine in economy. The subject is one full of interest, and we may return to it at another time.

RIB-RIFLED ORDNANCE.

We have received a little *brochure* from an anonymous pen entitled, "Rifling with Ridges in the Gun and Grooves in the Shot."* It is sharp and true to its aim, like a rifled point-blank shot. It comes *àpropos* as a sequel to the article on "Rifled and Smooth-bore Guns" in a recent impression. We do not know the author, but, he is so "to the manner born," we can give a shrewd guess, and so, no doubt, can many of our readers, that he is a well-known eminent artillerist.

"Rifling with ridges in the gun" means that kind of rifling in relief, on the bore of the gun, which we have before referred to as "rib-rifling." It is identical in principle with Mr. Lynall Thomas's plan.

The pamphlet starts with the assertion, "How to send a missile straight or as straight as possible to a direct mark, by the force of gunpowder, is the question to which artillery science cannot yet give a *definitive answer*." The proposition involved in this truism is the problem to be solved by artillerists. The rule for solving it is clearly and correctly laid down by the author—"*the centre of the shot must be brought into the centre of the bore.*" In the smooth-bored gun, he says, the centre of the shot is placed below the centre of the gun "by half the difference of the diameter of the shot and the bore, that is to say, the windage;" and he adds, "there must be windage in a muzzle-loading gun." That is true; but we must not lose sight of the cause which makes that truth a necessity. Without *some windage* it would be difficult, if not impossible, in rapid loading to ram the shot home into a muzzle-loader. This necessity applies to rifled as well as to smooth-bored ordnance, because it arises with reference to firing as well as loading. The great merit of the hexagonal form was claimed by its inventor to be the "mechanical fit," because it was a close fit and prevented windage. But Mr. Whitworth has been obliged to deviate from the close fit. The want of windage was a serious obstacle to loading. It also increased friction in the passage of the projectile out of the twisted rifling, and burst the gun. He now cuts away the angles of the hexagons on the shot, and tapers both ends so that they do not touch the bore. He thus obtains windage, but he abandons his principle.

No system of rifling hitherto invented wholly obviates windage. It is an essential condition of every plan yet tried, and especially of twisted rifling; for, as with the hexagonal, so with every other kind of rifling, the total absence of windage, by the immense strain it causes on the bore in firing, will burst the gun. Even the yielding nature of soft metal casing to the shot is not a guarantee against that disaster, as numerous examples with Armstrong guns testify. It is therefore not correct to state that windage is *per se* the cause of the irregular and uncertain aim of smooth-bored guns. The cause is the position of the shot, not the windage.

The author is more correct when he describes the causes of the deviation of aim with shot fired from a gun, in the words of Sir Howard Douglas and Dr. Hutton. Want of accuracy, according to the former, "arises from the reflections of the ball in passing along the bore, from which a shot acquires a zig-zag motion, and does not generally quit the the cylinder in the direction of its axis;" and the latter, in homely, but energetic terms, says, "The ball is kicked about from side to side; and it depends entirely on the part of the bore the shot last strikes, before it issues out of it, which course it may take."

This source of irregularity in the direction and flight of the shot, is common to rifled and smooth-bored guns; but it is incorrect to ascribe it directly to windage, as cause and effect, because, as we have already seen, the want of mutuality of concentricity in the vertical planes of the bore and the shot, as the latter passes along and out of the gun, is the real cause of uncertainty of aim.

The remedy, as the writer of the pamphlet lucidly explains, is to be found in "bringing the centre of the shot into the centre of the bore;" and this he shows, as it is quite obvious, can be effected by raising the bottom of the shot to a point above the bottom of the cylinder, which shall bring the two centres precisely on the same line, horizontally and vertically. This arrangement, however, which is the true solution of the question propounded in the first sentence we have quoted, is irrespective of windage. The projectile might be supported, or suspended and maintained during its passage out of the gun, in this concentric position, and still have windage space around it which, under that condition, would not disturb the straight direction of the shot. It would only cause a loss of projecting force by the escape of explosive gas.

"The first thing necessary," in the words of the author, "is to make certain that the projectile, while still in the gun, shall move (when propelled) centrally along the bore without striking, and with its centre and axis in and identical with the axis of the bore."

Having described the well-known irregularities of projectiles, he gives his opinion that "this dependence on chance, and all these causes of inaccuracy, will be removed by the expedient of ridges to the gun," that is, by *rib-rifling*. After condemning the "twist groove system as a make-shift, while the art of shooting straight is being invented," he proposes *straight* ridges, and describes the mode of applying them as follow :—"Four ridges in the bore, dividing it longitudinally into equal parts, and the ridges having one and the same elevation, will fix the shot, properly grooved to correspond with the ridges, exactly in the centre and axis of the gun ; and the projectile, if an elongated one, cannot have *any* obliquity of position. The ridges produce the effect of an interior concentric tube of the exact diameter of the shot, and when the discharge takes place the shot cannot possibly deviate from this axial line, and therefore will be delivered, clear of the muzzle, according to the line of aim, and in the true vertical plane of the gun's axis."

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* Published by T. and W. Boone, 20, New Bond-street, 1863.

All this is quite true. If there be windage, it means that the shot is smaller than the bore of the piece. That being the case, the bottom of the shot resting on the bottom of the bore, will bring the centre of the former below the centre of the latter, unless the shot be lifted the distance of half the difference of the two diameters, and poised in that position. This is precisely what, in the plan we are considering, is proposed to be done by means of the ridges or ribs. We are not, however, prepared to admit that the same effect may not be produced by groove-rifling. We see no reason why ridges on the projectile, and equidistant from its centre, should not fit as accurately to the bottom or edges of grooves, as grooves on the projectile to ridges on the gun. On the author's plan, the weight of the shot will bear mainly on the rib or ribs at the lower part of the bore. At every discharge the shot will slide along the rib, which by constant abrasion will be gradually worn away, and as this process continues the position of the shot will become lower, and its concentricity with the bore will be lost. If the suspension of the shot on side ribs be relied upon, a similar process will take place on the edges of the ribs.

On the other hand, ridges on the shot running in grooves in the bore, may be made to perform the same office of keeping the projectile in a straight course, and concentric to the bore. There would, no doubt, also be a tendency to rub down the bottom grooves in the gun, but it would be much easier to remedy this evil than in the case of the ribs in the bore. By a simple contrivance the ribs of the shot might be increased in diameter as the grooves were lowered by long usage of the gun. If, moreover, the bore, and consequently the grooves, were formed in a steel tube, and the ribs of the projectile were of a softer metal, there would be no abrasion at all of the grooves.

The writer of the pamphlet is very confident of the success of his plan of straight firing by directing grooved shot along parallel ridges or ribs. He comes to the conclusion that "the motion of the shot within the bore would be perfectly regular, uniform, and straight, and directed truly on the line of aim," and he regards twist rifling as a "make-shift."

But has he well considered the effect of twist rifling in giving to a projectile that rotary motion, which keeps it steady in its line of flight, which compensates any slight deviation from balanced weight, and even tends to check eccentricities of motion, just as the fly wheel regulates the motion of an engine and keeps it at a uniform speed and development of power?

Before it can be predicated that a projectile, issuing from a gun without rotary motion, will preserve its centricity and the line of its course perfectly straight, many comparative experiments require to be made. It is a theory for which the sanction of practice is wanting. All experience tends to prove that to keep a body, which is moving through space or through the air, true to its orbit or course, rotary motion is the natural law. We must, however, do the author of this interesting little publication the justice to say he has displayed great ingenuity of research in investigating the principles which regulate the flight of projectiles, and has opened a question which may throw a new light on the science of gunnery.

MR. REED'S PAPER AT THE NAVAL ARCHITECTS' INSTITUTION.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I was not a little amused to hear my friend Mr. Reed, in his paper on armour-plated ships, read at the late meetings of the Naval Architects' Institution, quoting from a paper of mine printed in the "Transactions" of the previous year, on "Jointing and Rivetting Iron Ships," and very adroitly turning my own arguments against myself. You inserted Mr. Reed's abridgement of his paper on the 20th ult., and on the 10th inst. with equal gravity wrote a long leader on the same subject, with still longer quotations from my paper, using the same ingenious device as Mr. Reed had done. The writers of both papers, no doubt, had a good laugh at my expense, as they could have had no graver object in so applying what I had written ; both are perfectly aware that, do their best, they can but bolster-up a bad cause, in which they are not themselves believers—at least, if I may take the writings and arguments of both as employed on former occasions.

But the fact is, the Secretary to the Admiralty and the Controller are at their wits' end to know what to do;* and while both are enlightened men, and see what it must all end in, yet, in the meantime, how to overcome the pressure put upon them by the respectable, practical, old-school men around them they know not, and so iron must be abused and wood upheld for a time at all hazards ; and perhaps nothing showed this more glaringly than my friend Reed's paper. If he really wishes to know my views, and to quote them, let him read back and see some feeble pictures (drawn from nature) by which I have attempted at various times to illustrate how utterly hopeless is the cause of wood, and how absurd it is to cling to a system now so fairly distanced. He will there see—what, by-the-by, he knows as well as I do—something of the effects of dry-rot, of bad fastenings, of straining seams, of quivering stern-frames to which they dare not apply the full force of the engines, and a few more pleasing symptoms which may be cloaked over in the Navy, but which have long since sent wood into oblivion in the mercantile steam marine. There is, however, a real difficulty in introducing iron hulls generally into the Navy, and this is a most convenient peg on which the Admiralty hang their objections, while they steadily and obstinately refuse to try simple means for its removal, though pressed upon them for several years. The fact is, if there were no fouling, the Government could not possibly maintain their ground. It all rests there.

In a more serious tone I would also ask, would a *well-built and well-proportioned iron ship* have gone to pieces so soon, under the circumstances, as did the new ship "Orpheus"? From all I can see, I think not. Iron ships are easily penetrated on rocks, but are tough things to *break up*—"Birkenhead" and "Royal Charter" notwithstanding.

Now, if Mr. Reed wishes to root himself firmly in the confidence of the practical and thinking men of the day, he will throw off the fetters that surround him, and not pledge himself by writing up what he knows cannot stand long, but gradually prepare those whose adviser he now is for the entire abandonment of a system which has long since received its death-blow, and which a powerful body of men in the House of Commons are resolved shall not much longer be shelved.

I feel, after thirty years of consistent advocacy of iron ships, that I need not on every occasion go over the old and threadbare arguments in favour of the system, but may, when occasion requires, openly tell shipbuilders where faults still exist and suggest improvements, and ask all to keep a watchful eye on every point, so that we may reap still greater advantages from the change which is now happily out of the reach of any shafts that its unhappy opponents may still endeavour to launch at it.

Your obedient servant,
John Grantham.

31, Nicholas-lane, London, April 13, 1863.

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* *Vide* Admiral Robinson's instructive paper on the Private Iron Ship Builders.

REVIEW.

The Working of the Steam Engine Explained by the Use of the Indicator; *or, An Exposition of the Best Means of Producing the Greatest Impulsive Effect from a Given Quantity of Fuel; with a Description of the Mode of Expanding Steam, and the Compounding of Engines.* By Joseph Hopkinson. Illustrated with Engravings and Diagrams. 4th edition, enlarged and improved. London: John Weale, High Holborn. 1863.

[Second notice.]

We now come to that part of Mr. Hopkinson's book in which he treats on the use of steam expansively, by means of one cylinder or of two compounded cylinders, and in which he gives directions for the management of the steam engine, boiler, and furnace. Interspersed with the above matters, there are short chapters on throttle valves, metallic packings, cased cylinders, &c. We have very few objections to raise against this part of Mr. Hopkinson's work; indeed, for its popular and clear treatment of the various working steam apparatus, it deserves great praise. The explanation of the principle of expanding steam and its adaptation to various forms of steam engines, is very clear and intelligible, and these chapters are admirably suited for the study of ordinary enginemen and their unprofessional employers.

We will forbear to point out the many outrageous grammatical mistakes that are to be encountered during a perusal of this book ; let it be sufficient for us to say that but in very few instances do these mistakes interfere with the clear understanding of Mr. Hopkinson's meaning. We will also refrain from further allusion to the different attacks of Mr. Hopkinson on Mr. McNaught, Messrs. Petrie and Co., of Rochdale, and on Boiler Associations and their inspectors generally; Mr. Hopkinson gives his reasons, and they are often very good ones. At the same time, we cannot help regretting the want of good taste that leads a man to continually thrust *his* indicator, *his* boiler, *his* safety-valve, *his* equilibrium-valve, &c. &c., before the readers of his own work. Honest criticism is a literary police force ; and it is as condemnable in a literary critic as in a police constable to wink at offences that both are bound to point out.

The author brings forward the patent of Messrs. James and John Roberton, of Glasgow, taken out in 1800, as being an identically similar one to a 1845 patent of Mr. William McNaught, of Glasgow. There are many patents for real inventions that could be matched in a similar manner, by ransacking the old specifications under the law previous to 1852. Mr. Nasmyth's hammer patent was invalid, for a similar reason, all the time he was making his fortune by the steam-hammer. Before Mr. Woodcroft published his patent index, the difficulties of a search amongst the old omnibus patents were of a superhuman character. We certainly concur with Mr. Hopkinson in his remarks on the use, and his strictures on the abuse, of placing an additional cylinder at the other end of a beam engine; and the information and opinions enunciated on the matter by Mr. Hopkinson, are very well stated.

In alluding to the unnecessarily large and often badly constructed boilers that are generally used in the Lancashire districts, the author says, that "It is truly awful to contemplate the force pent up within large boilers from six to ten feet in diameter, and from twenty to forty feet in length. No good reason can be assigned for the use of such *large engines of destruction*; for the quantity of metal contained in these large and unsafe structures, would produce boilers of many times the strength, and of double the power, with a less expenditure of fuel, were they only constructed of a proper form." We believe that the employment of cast steel will also greatly further the use of high pressures of steam and of corresponding rates of expansion. We will take occasion to allude to this important direction of engineering progress.

The author says, at page 233, that "An engine may be quite safe when new, working out a given power; but by continued use the metal, from constant action and reaction, becomes granulated, and less able to resist strain and concussion." This sentence enunciates a somewhat parallel opinion to that in a Paper, read some time ago, before the Institution of Civil Engineers, by Mr. Frederick Braithwaite, C.E. The essay was entitled "The Fatigue of Metals." The mystery that still hangs over the molecular structure of metals would seem to point out that, as yet, inadequate means have been adopted to clear up the influence of the structure of the ultimate atoms of bodies on their powers of cohesion.

Mr. Hopkinson seems to recommend the use of a small high-pressure engine in each room of a mill. This would result in a saving of heavy shafting and gearing required to get up the speeds, and each room would be independent of any other. The system of several small independent engines is already in use in works where no very great regularity of speed is required—such as engineering workshops, rolling mills, &c. We believe that Mr. Nasmyth, of Patricroft, was the first to employ this plan. At present, however, there is no system of steam-engine governor exact enough to render this division and scattering of steam power applicable to cotton spinning. Before Watt's centrifugal governor exerts its influence on the throttle valve an alteration of speed must have already taken place, with a consequent deterioration in the work produced by the spinning machinery. It is evident that the speed of a single large engine must be easier to regulate, than if the same power were divided into several small engines.

We agree with Mr. Hopkinson in his favourable opinion as to the horizontal form of engine, and we are fully prepared to endorse the dictum of a spirited gentleman, "Mr. M——," quoted by the author (Page 272), as "offering any man present (at a meeting in Rochdale), if he was in favour of beam engines, £5, if he did not say, after he had seen both working, that horizontal were superior to beam engines. He would give the £5 as freely as ever he gave a shilling to his wife." At the same time, there is an undeniable tendency in the lubricating matters used in a horizontal cylinder to gravitate to the bottom, leaving the top half exposed. Mr. Richard Roberts, the famous engineer, stated, at a meeting of the British Association in Manchester, that he often found horizontal engines to wear away on the top half of the cylinder. This appeared a paradox to many present. It sometimes happens, if the engine be badly made, that, when the packing rings wear away, the body of the piston touches the lower half of the cylinder, and when the steam leaks past the rings, through the usual slits, for the V's, the whole piston is pressed down on the lower half of the cylinder. The real thing, no doubt, is to have a good hard quality of metal for casting the cylinders; this metal should be distinct from the usual material run from the cupola, and it should be formed of a particular combination of different irons.

In a chapter on cased or "steam jacketed" cylinders (page 306), Mr. Hopkinson points out the liability of the diagram to be vitiated by the steam issuing through any bad joints between the case and the cylinder. A diagram is given as an instance. Another very interesting diagram is given, showing the influence of the use of a jacket on the consumption of steam. Certainly the indicator is the only true and easily available means of getting at the internal action of the steam engine.

It is stated (page 318) that the greatest drawback to the use of the injector consists in the obligation to use *cold* feed water, at a temperature not higher than 80 deg. We believe, however, that it is only necessary to *start* the injector with cold water; the current being once established, it can be continued with hot water. This requires a particular arrangement, which we understand has formed the subject of a patent.

The chapters on the management of the engine, boiler, and on stoking the furnace, are, we repeat, excellent. Mr. Hopkinson says, truly enough (page 325), that a column of mercury is the most exact pressure gauge, and we only hope that he marks out the scales of his indicators by means of this instrument. He also gives an ingenious way (page 334) of clearing the rose of the feed pump, should it become choked, without stopping the pump in getting down the rose. A small pipe and tap are fixed under the bottom clack-valve of the pump, the top of the pipe being open to the atmosphere. When the pump is working the tap is, of course, closed, but on opening it the pressure of the atmosphere will react on the water column in the suction-pipe of the pump. The water between the bottom clack and the rose will thus rush back with a proportionate force, and will blow the dirt or any leaves, &c., off the rose.

In giving, at pages 338 and 339, directions to calculate from a diagram the quantity of steam used by an engine, Mr. Hopkinson knows as well as we do that such an estimation only slightly approximates to the real quantity of steam used. Take, for instance, the case of an engine priming to some extent; what a loss of power and heat there must be, when particles of water are mechanically conveyed by the steam. In reference to some remarks of Mr. Hopkinson's, pages 276 and 277, in which he appears to deny the liability of an engine priming from its being placed lower than the boiler, we may observe that when the boiler *does* prime, it is evident that there is less chance of the steam getting rid of its mechanically combined water when the cylinder is on a lower level. Our attention has been directed to this by a case in our own experience:—Mr. Hopkinson says: "Reasoning on this statement (as to the liability to prime of engines on a lower level than the boilers), it must follow that in locomotives, and other engines where the cylinders are placed below the boilers, the engines must prime, and be subject to breakdowns." There is always a dome for drying the steam of locomotive engines, and also generally a "baffle plate," or perforated plate, placed in the dome to act as a strainer or cullender on the steam. Boilers, however, often prime in an intermittent and scarcely accountable way.

Under the heading of the "Strength of Iron Bars and Boiler Plates," we find some valuable, if not quite original, hints on the construction of boilers. The author points out the injurious influences of punching and "drifting" on the riveted joints of boiler plates. He also advocates heating the plates before bending; for, besides thus preserving the tenacity of the plates, "if there were any flaws in the metal, these would sooner show in the plate when in a heated state." The advantages of boring the rivet holes are also pointed out. Mr. Hopkinson lays the blame of a boiler explosion at the door of the Manchester Association for the Prevention of Boiler Explosions. The boiler referred to, one belonging to Messrs. Hargreaves, of Accrington, was tried by means of the hydraulic test, at the instance of the inspectors of the association. The boiler was tested to 70 lb. to the square inch, while the original extreme working pressure was a little under 40 lb. to the square inch. In about three months after the hydraulic test had been applied, the boiler exploded. Mr. Hopkinson is convinced that the testing had injured the structure, causing a gradual deterioration. The flues had been strained and distorted by the test.

In a voluminous appendix at the end of the book Mr. Hopkinson has given a great variety of tables; most of the tables, in fact, that are found in engineers' pocket-books. There are also some recipes "for cements for joints, to be purchased of Messrs. Hopkinson and Co." Amongst these various tables, Mr. Hopkinson might as well have given a table of the heights and corresponding pressures of the mercury barometer, thus enabling the possessor of the work to estimate the effect of the weather, or rather of the barometric pressure for the time being, on the vacuum in the condenser, and its resulting quality of the vacuum shown by the indicator diagram. Mr. Hopkinson probably does not consider this necessary, as the average pressures on both sides of the piston are not affected by the height of the barometer; and as regards the quality of vacuum itself, he will probably say that the amount is too slight to be noticed; but he here again shows a want of due appreciation of true scientific accuracy.

VISIT OF THE LORDS OF THE ADMIRALTY TO THE ATLAS WORKS, SHEFFIELD.

On Thursday, last week, the Lords of the Admiralty paid a visit to the armour-plate works recently erected by Mr. Brown, in Sheffield. The *Times*, in its account of the visit, gives the following particulars:—The visitors were conducted through the extensive new and old mills and workshops, where some 3,000 hands were busily engaged in melting, bending, hammering, and twisting great masses of seething iron into every conceivable form its stubborn nature could be made to take. It was really a wonderful sight. On every side, amid thick smoke and deafening clamour, the blazing rites of Moloch—the furnace God of old—were being celebrated. Great furnaces, blaring in the fierce white glare which shone from their crevices, were stuffed to the mouth with monstrous cranks and shafts, and uncouth bosses of red-hot metal. Every now and then some one of them was opened, with a flash that filled the smoky atmosphere with a glare as from snow, and a mass of metal, seething and sputtering in a blaze of sparks, was dragged off and moulded, like so much wax, under the blows of steam hammers that made the earth tremble and the whole building to jump and chatter under the stroke, as if from the shock of a little earthquake. It was wonderful to see the skill with which the groups of workmen, uniting all their individual exertions in a series of violent efforts like a weird species of dance, contrived to hedge and move about the great masses on the anvils, so that the hammer struck only where and how they chose. While the heat lasted in the mass, and that was for a long time, they never paused or slackened in their work, and though literally almost scorched by their proximity to red heaps they kept on toiling till the work was done, and the lump that a quarter of an hour before was almost melted iron was picked up by some huge crane that came travelling along the smoky walls, and carried off, glowing through the gloom, a finished piece of work. At other places there were tilt and lever hammers, wearying the very air with the clattering din of their tremendous strokes. At others great ingots of steel were cast by the Bessemer process, small plates were rolled and roughly cast aside in great red slabs to cool, or hurried backwards and forwards in iron trucks, scorching even the hardened workmen out of their tracks as they came burning past. On every side there were furnaces and smoke and red-hot metals, while in out-of-the-way nooks men in steel caps and wire vizors, and cased below in rough steel leggings, like jack-boots of iron, fought in a crowd like so many salamanders round some rough mass that was dangerous in its fierce heat, and which sent back aggressive spurts of red-hot metal in return for every blow. Such fiery combats as these were going on in all directions; the "Sheffield carpet" of the factory —iron plates—was hot and painful to the feet; the air was arid with a sulphury warmth that was like the glow of an overheated stove. When we have said thus much, and added that there were roaring pipes of steam mounting into the air side by side with great iron trumpet-shaped piles of chimneys, out of which jets of red flame roared and flapped into the smoke above like gigantic flambeaux; that lower down long lines of lathe bands flew noiselessly in all directions, and that the background was filled in with glimpses of ponderous fly-wheels whirling their arms through the smoke and turning rolling mills or lapping hammers, or shearing down with noiseless might the great lumps of iron that were brought in to be cut up,—we have said enough to indicate the view which met visitors on their first introduction to this glowing scene of industry. Though not the first, yet by far the most important process which their Lordships were shown was the operation of rolling the great plate—by far the largest single plate that has ever yet been rolled in the world. This took place in what are called the New Mills of the Atlas Works, which were used on Thursday for the first time, and where great ranges of furnaces have been erected, with their mouths opening on the iron tramway which leads direct to the double rollers through which the plate passes. One may guess at the solidity required for mills of this kind when it is stated that some of the rolls used at this mill on Thursday have a first foundation of no less than 60 tons of solid iron, resting on masonry carried far below the earth. The rolls themselves are 32 in. in diameter and 8 ft. wide, and are turned by an engine of 400-horse power, putting in motion a fly-wheel large enough apparently to make a world rotate if only well balanced on its axis. A powerful screw, applying its force through compound levers, allows the distance between the rollers to be adjusted to the fraction of an inch, so that the plate which on its first rolling is forced through an interval of, for instance, 12 in. apart, is on its next wound through one of 10, next through one of 8, and so on till the required thickness has been carefully and equally attained by tremendous compression through every part of the metal. There were a great many visitors to see the rolling of this formidable mass, which was fortunate, as one would certainly be frightened to witness the terrible process alone. After some delay and quick glimpses made by the most hardened workmen, who, rushing up to the door of the furnace, got a half-blinded glance into its white interior, it was decided that the mass was ready, for, strange as it may seem, an armour-plate requires more than mere heating, and has to be cooked and watched in its cooking with as much care as if it was an omelette, and the plate that is drawn before it is "done to a turn" generally remains a permanent ornament of the unlucky manufacturer's workshop, which no one will have at any price. When at last this eventful moment had arrived on Thursday, the door of the furnace was slowly raised, and a colossal pair of pincers, with very long handles fastened to a chain drawn by machinery, was swung in. For an instant some men rushed forward, and, shielding their faces from the deadly heat that shot from the furnace, adjusted the bite of these forceps on the plate, and then ran back as the chain began to tauten, and the great inmate of the blazing den was slowly dragged forth on to the long iron trucks in front of the door, and there lay in its huge length and thickness a mass of living fire, which none could approach, or scarcely even look at, so fierce was its glow and terrific heat. The chains that should have pulled it forthwith to the rollers were too slack, and then arose shouts, and cries, and commands, as the men did battle with this mass of fire, coming so near it in their attempts to gather up the slackened chains that one literally almost expected to see them fall scorched and shrivelled on the ground. In its great glare they fought and struggled with the chains till at last all was adjusted, and the great pile of angry fire began to move slowly downwards towards the mills, the men following it with hoarse shouts and directions, now hid in steam, as buckets of water were dashed over the mass, and the next moment standing in an atmosphere of white light, to which the light of the day around was mere dusk. The rollers did not bite directly the the mass came to them, and when they did the engine was almost brought to a standstill by the tremendous strain upon it; but at last the soft plate yielded, and the rollers seemed to swallow it as they wound it slowly in, squeezing out jets of melted iron like squirts of fire that shot about dangerously as the pile was compressed from 19 in. to 17 in. thick by the irresistible force of the rollers. *Ce n'est que le premier pas qui coute*, and the victory was certain when the mass had once passed through the mill, and both visitors and workmen gave a tremendous cheer at the success. From this time it was kept rolling backwards and forwards, the workmen sweeping from its face the scales of oxide that gathered fast upon it with long-handled besoms, that, though soaked in water, caught fire and blazed up as fast they were used. With every time it was passed through, the rollers were screwed closer and closer together, as we have already mentioned, till at the end of about a quarter of an hour after leaving the furnace an almost melted mass, it was passed through for the last time, and came out opposite the furnace door it had so lately left, no longer shooting forth spiteful sparks, but shorn of half its heat, subdued, and moulded to its proper form—a finished armour-plate, weighing 20 tons, 19 ft. long, nearly 4 ft. wide, and exactly 12 in. thick throughout from end to end. This is the most signal triumph that any rolling mills have yet achieved.

Other smaller plates were then rolled with a quickness and certainty that proved the skill already gained in this new and most important branch of manufacture. One plate was 17 ft. long, by 4 ft. broad, and 5½ in. thick; one 19 ft. long, by 4½ ft. wide, and 4½ in. thick; one we have already alluded to, 41 ft. long, by 3 ft. 10 in. broad, and 4½ in. thick. A lesser plate was also rolled 18 ft. long, 5 ft. wide, with a thickness of 6 in. on one edge and 3 in. on the other. The method of converting cast iron by the Bessemer process into the tough soft Bessemer metal, a combination of the qualities between soft steel and tough wrought iron, was next shown. It is needless now to enter on a description of the very beautiful and very terrible process, to witness, which the metal goes through in the converter as it is stimulated to a white heat by the passage of the air blown by force-pumps upwards through the mass. No fireworks can surpass the brilliancy of the display this process affords as it approaches its completion, and the stream of violet flame and clouds of burning sparks pour from the mouth of the converter as from a gigantic squib. Nor is it necessary here to enter into a detail of the now well-known process, which was a subject of such controversy a few years since, but which is now being so generally and advantageously adopted throughout England and the Continent. Suffice it to say that in twenty minutes from the time of putting in the charge of cast iron, it was, without any expenditure of labour, poured out into the mould an ingot of soft, tough steel, weighing three tons. This metal, after undergoing hammering, is now most extensively used for steel rails at stations, points, and junctions, where the wear is great, and in these trying situations it seems almost indestructible. A great deal has also been used in making Blakely rifled guns in this country for both Federals and Confederates. These are the ordnance which the Americans always speak of as Parrott guns, and by them they are more highly prized than those of either Armstrong or Whitworth. Yet it was stated that the Ordnance Select Committee have refused even to try these guns at Shoeburyness. After these processes were over, and the various planing and filing shops had been duly examined, the visitors were entertained by Mr. Brown at a most sumptuous *dejeuner*.

THE FOULING OF SHIPS.

The following is the substance of a paper read before the last general meeting of the Institute of Naval Architects, "On the Protection of Iron from Oxidation and Fouling," by Mr. W. J. Hay, chemical lecturer of the Royal Navy College, Portsmouth:—

The author remarked that a few years back the disadvantages arising from the oxidation and fouling of iron, and the consequent necessity for docking, as well as a loss of speed, almost led to a determination on the part of the Admiralty to discontinue the construction of iron sea-going ships. But at a time when the executive were debating about the sale of the whole of the iron ships the results of several experiments became known. A preparation of oxide of copper had been tried upon the "Undine" and several other vessels, and answered so well that the Government decided upon retaining those iron vessels which they had not sold. The author had tried many experiments that had occurred to him, but none stood the required tests so well as oxide of copper. An experiment was tried on the "Rocket" in May, 1845. On examination the results were found so satisfactory that, at the suggestion of Admiral Sir Hyde Parker, she was coated in June, 1857, with alternate stripes of red lead and copper composition, and when docked about the middle of 1848, she presented a curious appearance, many of the red lead patches being corroded and having weeds 3ft. or 4 ft. long; while the patches of composition were generally covered with a little slime, but there was neither weed nor corrosion on them. A second experiment was made in September, 1845, on H.M. yacht "Fairy." Three different kinds of composition were then tried. With reference to the first two—one by a Mr. Owen, and the other by Baron Wetterstedt—oxidation had gone on very rapidly, while the third, which consisted of a composition of pitch, naptha, and copper oxide, chemically prepared by the author, no oxidation had taken place, and the only defect perceived in it was a partial flaking off occasioned by its being put on the bottom while in a wet state. Another experiment was tried on H.M. ship "Recruit," in April, 1847. The copper oxide preparation was put on the port side, and burnt linseed oil and red lead on the starboard side, excepting a space amidships, 4 ft. square, to which the oxide of copper preparation was applied. On her return to the Tagus, the port side was found to have no adhesions, except about one dozen small barnacles; while the starboad side, excepting the space 4 ft. square, was covered with bushels of the *Lepus Anatifera*, or duck barnacles. Of all the various compositions tried, oxide of copper had, up to the present time, been unequalled as a protector of the iron. The next best materials for protecting iron were the waterproof glue, and a varnish of foreign asphalte and mineral pitch dissolved in rectified naptha; but these required great attention to the quality of materials, and also to the application of them. The basis of the anti-fouling preparation, which had for years past been used in H.M. Service upon the author's recommendation, was sub-oxide of copper. The oxides of copper used for this purpose were the scales separated from the sheets of copper in the "pickling" process. These scales, after being pulverized, were mixed with a varnish made of vegetable pitch and rectified naptha. The author wished it to be understood that the protective coating, when used with the oxide of copper anti-fouling composition, was not intended merely to act as a non-conducting medium to prevent galvanic action, but to protect the iron from chemical action resulting from the action of air and sea-water on the iron. It appeared to him that this action was little understood, judging from printed statements which occasionally appeared, and which attributed the loss and corrosion of iron to galvanic action of copper preparations. The copper oxide paint could not act as a galvanic agent, as every particle of oxide of copper was insulated by the oil or varnish in which it was enveloped, and unlike preparations of a metallic character, which had been frequently tried, and required oxidation previous to combination with chloric acid, the oxide of copper was, as soon as uninsulated, ready for chemical combination with the elements of the sea-water. The author admitted that one great difficulty had existed since the first use of copper oxide—that of requiring careful supervision in its application; for when the varnish was made too thick it became locked up, and much of its usefulness was destroyed in not coming in contact with the sea-water; and, on the other hand, when the varnish was made too thin, the oxide sank to the bottom, and, if the mixture were not continually stirred, it got left there, and did not reach the ship. He had now, however, he stated, succeeded completely in suspending the copper oxide during its application. He takes the puce-coloured or sub-oxide of copper and roasts it till it takes up another equivalent of oxygen and is converted into black oxide. This is then boiled with linseed oil until it assumes its original pure colour as sub-oxide; the oil so treated becomes a quick drying oil, and is capable of suspending a large amount of copper oxide. In his plans for the anti-fouling composition, the author included the application of zinc plates inside and outside the hull of the ship to prevent oxidation from abrasion or other causes. There were numerous parts of iron ships-of-war which required chemical supervision, as not only should every metallic fitting electro-negative to the iron be insulated, but every piece of timber should be insulated, especially in the bilge; for when wood decayed in contact with iron and sea-water it produced sulphuretted hydrogen. Certain woods, however, were less liable to decay than others when in contact with iron, and among them were teak and stink-wood. In conclusion, the author alluded to the statements made respecting the foulness of the "Warrior's" bottom. He said that after she had been out of dock nine months, she had no oxidation whatever on her bottom, although she was coated with the greatest expedition, it being then thought that her presence would be required in American waters.

COWAN'S GUN THIMBLE.

Fig. 1.

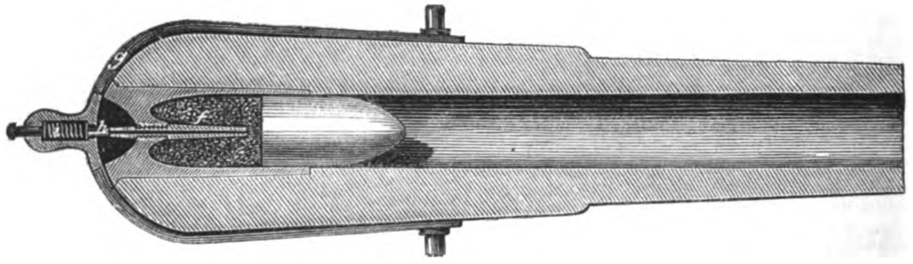
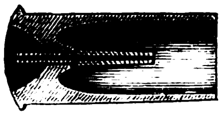


Fig. 2.



COWAN'S CARTRIDGE CASE OR GUN THIMBLE.

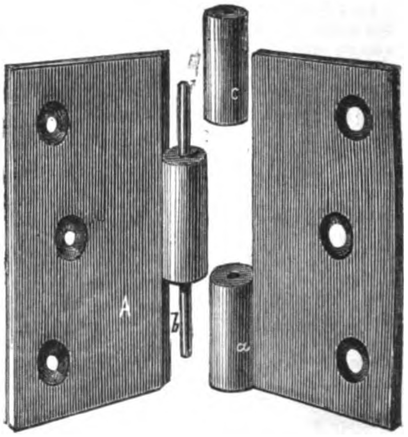
The above engravings illustrate a cartridge case or thimble recently patented by Mr. B. F. Cowan, of Euston-square. The thimble is made of any suitable material, and so formed as to fit into the breech end of a gun, as shown at fig. 1. It is held in the gun by a strap or other contrivance: the strap is shown with a projection or knob, in which a spring is inserted to keep the rod or pin upon the nipple. The thimble has slits cut in it, as shown at fig. 2. These slits make the sides of the thimble more or less flexible, so that the bore of the thimble towards its open end can be expanded by an internal or contracted by an external force. This thimble contains the whole of the charge of powder or other explosive material, and may contain also, as may be found convenient, the whole or the rear portion of the projectile or shot. When the explosion takes place, the gases thereby generated expand the thimble, and cause a proportionate amount of frictional pressure against the breech chamber, that is, the inner surface of the sides of the gun surrounding the thimble, so that the expansive force of the ignited charge is employed to counteract its tendency backwards. The ignition of the charge may be effected by the action of the spring, driving the pin or striker upon the percussion cap on the nipple.

AN IMPROVED STEREOSCOPIC INSTRUMENT.

At a recent meeting of the Franklin Institute, United States, Mr. E. G. Chormann exhibited an improved stereoscopic instrument. It consists of an outer and an inner casing, and a frame; the inner casing sliding within the outer one. To the front edge of the frame, which slides into the inner casing, is hinged two arms, each of which is provided with a ring for holding a lens. When the instrument is to be used, the frame is drawn from the inner casing as far as possible, without entirely removing it therefrom, and the arms turned out so as to be at right angles to the frame, the picture being secured to the outer case by a flat spring, which holds it against the the same. The glasses may be applied to the eye as in the ordinary stereoscope, and the adjustment made by sliding the inner case back and forth within the outer one, until the proper focus is obtained. When not required for use, the arms holding the lenses may be folded together within the frame, and the latter pushed into the casing; the whole being thus condensed into a compact form of such dimensions as to be contained within the vest-pocket without inconvenience to the wearer.

ARCHER'S PATENT HINGE.

The hinge here illustrated represents one of those devices which are very useful in a great many cases. By the arrangement of the parts with relation to each other, the hinge can be used either at the right or left hand of a door. The construction of it is very simple, and is clearly explained by the engraving. One leaf of the hinge A has the screw-holes countersunk on both sides. The joint in which the pintle *b* works, extends but a short distance from the end and fits over the pintle when in its natural position. The small cylinder *c* is intended to be slipped over the pintle also, thus making the connection between the several parts complete. When necessary, the change from right to left hand can be effected instantaneously by simply removing the loose cylinder and turning the leaf A upside down from its former position. The advantage of such an arrangement as this will be readily appreciated by builders and other interested in such matters. This hinge is the invention of Mr. G. W. Archer, of Ipswich, Mass.



ON ALUMINUM BRONZE.

Lieut.-Colonel Strange has communicated to the Royal Astronomical Society some interesting observations on the use of aluminum bronze as a material for the construction of astronomical and other philosophical instruments. Col. Strange remarks that, "the qualities of most importance in instrument making are—(1) tensile strength; (2) resistance to compression; (3) malleability; (4) transverse strength or rigidity; (5) expansive ratio; (6) founding qualities; (7) behaviour under files, cutting tools, &c.; (8) resistance to atmospheric influences; (9) fitness to receive graduation; (10) elasticity; (11) fitness for being made into tubes; (12) specific gravity."

Tensile Strength.—The mean of experiments made by Mr. Anderson at the Royal Gun Factory, Woolwich, shows that the average breaking tensile strength of aluminum bronze is 73,185 lb. per square inch, while that of gun-metal is 35,040 lb., the ratio being rather more than two to one in favour of aluminum bronze.

Resistance to Compression.—Experiments made by Mr. Anderson show that no effect was perceptible until 9 tons 2 cwt. per square inch was applied, when the specimen gave .006 of an inch; on removing the weight an elasticity of .001 was observed, giving the first permanent compression as .005 of an inch. The ultimate amount of compression applied was 59 tons 2 cwt. 1 qr. 4 lb. (132,416 lb.), under which the specimen became too much distorted to permit of more weight being applied with any true result.

Malleability.—Mr. Anderson states that, "the qualities of this metal for forging purposes would appear to be excellent; with the exception of the part heated to a red-heat in the shade, all show that it is a good workable material under the hammer almost up to the melting point." Col. Strange adds, that there were specimens exhibited in the Industrial Exhibition at London which showed that the alloy could be drawn out under the hammer almost to a needle point.

Transverse Strength, &c.—Messrs. Simms found by experiment that aluminum bronze was 3 times more rigid than gun-metal, and upwards of 44 times more rigid than brass; and, in regard to its *expansive ratio*, they found this alloy less affected by change of temperature than either gun metal or brass—a little less than gun-metal, and much less than brass. Its *founding qualities* are such that it produces admirable castings of any size. It does not clog the file, and in the lathe and planing machine the tool removes long elastic shavings, leaving a bright, smooth surface. It can be worked with much less difficulty than steel, and, notwithstanding its greater cost, the Messrs. Simms think that screws made of it would in the end prove less expensive than steel. It tarnishes less readily than any metal usually employed for astronomical instruments. It is remarkably well fitted to receive graduation, as it takes a fine division which is pure and equable, surpassing any other *cast* metal in this respect. Col. Strange remarks that in its elasticity it is said to surpass even steel, and it would therefore appear to be the most proper material for the suspension springs of clock pendulums. Regarding *its fitness for being made into tubes*, it can be soldered with either brass or silver solder; it can be rolled into sheet metal, and it can be hammered and drawn. Gun-metal does not admit of being rolled, so that hitherto the tubular portions of telescopes and other instruments have been made almost exclusively of yellow brass, an alloy very deficient in rigidity. The *specific gravity* of the alloy containing 90 copper and 10 aluminum is according to Messrs. Bell, 7·689, very nearly that of wrought iron.

Col. Strange adds, "It appears, from these experiments and from the concurrent testimony of those who have given it a fair trial, that the 10 per cent. aluminum bronze is far superior, not in one or some, but in every respect, to any metal hitherto used for the construction of philosophical apparatus, and that for such purposes it may be employed in the dimensions that would be proper in the case of cast steel. All parts which would otherwise be made of steel may with perfect safety, and even with advantage, be made of the new alloy, particularly such parts as bolts, and fixing, tangent, and micrometer screws. Its hardness and comparative inoxydizability point it out as peculiarly adapted for pivots, axes, and bearings. If employed for receiving the graduation of circles, the necessity for inlaying another metal will be obviated, by which two advantages will be gained: the hammering which forms part of the operation of inlaying, and which, more or less, must cause unequal density and tension in the circle subjected to such treatment, will be dispensed with; and the effect of inequality of expansion, in the circle and the inlaid strip, will no longer be a cause of apprehension. With respect to the due visibility of divisions cut on this metal, opinions will perhaps differ. I can only say that I should be well content to observe with them."

This alloy has been selected by Col. Strange as the most appropriate metal for the construction of the large theodolite for the use of the Trigonometrical Survey of India. The horizontal circle of this theodolite is three feet in diameter, and the effect of using this alloy will be to keep the weight of the instrument within reasonable limits, notwithstanding its possession of means and appliances not hitherto bestowed on such instruments. In the manufacture of the alloy, Col. Strange says that extremely pure copper must be used; electrotype copper is best, and Lake Superior copper stands next, giving an alloy of excellent quality. The ordinary coppers of commerce generally fail, owing, it is said, to the presence of iron, which appears to be specially prejudicial. Further, the alloy must be melted two or three times, as that obtained from the first melting is excessively brittle. "Each successive melting, up to a certain point determined by the working, and particularly the forging properties of the metal, improves its tenacity and strength. It is probable that after several meltings there will remain in combination with the copper a somewhat smaller proportion of aluminum than 10 per cent. The present price of English-made 10 per cent. aluminum bronze is 6s. 6d. per lb. This is four or five times that of gun-metal, but a much smaller quantity of the new alloy than of gun-metal will give the same strength; and when it is considered how small a ratio the cost of material bears to the cost of workmanship in refined apparatus, it will be found that even at the present price of the new alloy its cost is not prohibitory, whilst the advantages attending its use promise to outweigh the increased expenditure."—*L. E. and D. Phil. Mag.*, [2], xxiv., p. 508.

C. Tissier, director of the aluminum works at Rouen, shows that one per cent. of aluminum in copper makes the latter more fusible, giving it the property of filling the mould at casting, at the same time preventing it from rising in the mould. The action of chemical agents upon it is also weakened, and the copper gains in hardness and tenacity without losing its malleability, thus producing an alloy which has the malleability of brass, with the hardness of bronze.

In transverse strength this alloy was found to be more than twice as rigid as either brass or copper. Tissier also finds that one part of aluminum, added to bronze consisting of 96 copper and 4 tin, gives an alloy of a fine colour, of remarkable homogeneity, of great hardness and malleability. During casting, this alloy does not oxydize at all, and it is therefore free from the oxyde coating with which ordinary bronze castings are covered. The transverse strength of the castings of this alloy Tissier finds to be two and a half times that of the original bronze, and that of the hammered alloy is four times as great as that of bronze. Ordinary cannon bronze, 89 parts copper and 11 tin, has the same transverse strength as castings of the new alloy. In reference to the hardness, tenacity, and malleability, it is equal in these respects to aluminum bronze, made of 90 parts copper and 10 parts aluminum, and, as it is considerably cheaper, it can with advantage be substituted for this more expensive alloy.—*Polytechnisches Journal*, clxvi., p. 430.

NORTH OF ENGLAND INSTITUTE OF MINING ENGINEERS.

The general monthly meeting was held in the rooms of the Institute, Neville-hall, Newcastle, on Thursday—the president, Nicholas Wood, Esq., in the chair.

The following gentlemen were elected members of the Institute:—Mr. John Nixon, East Colliery, Gateshead; Mr. John Wood, Flockton Colliery, near Wakefield; Mr. Thomas Cookson, Pargate Colliery, near Rotherham.

The President stated that the Council had been engaged that morning in endeavouring to make some arrangements relative to the proposed special general meeting of the Institute, to be held at the same time as the meeting of the British Association in August. The sub-committee appointed for this purpose had had an interview with the local executive committee of the British Association, and they had also been in correspondence together, and there seemed to be several difficulties in the way of the meeting being held after the same manner as at Birmingham, as was originally proposed. The Council would lay a special report before the members, but the substance of the recommendations might be stated as follows:—That a circular be issued to all the members of the Institute, informing them that the rooms of the Institute would be open for them and their friends during the meetings of the British Association; and that special meetings of the Institute would be held every morning before the openings of the sections of the British Association, so that members not residing in this neighbourhood would thus meet the resident members of the Institution, several of whom are connected with the executive of the British Association, and could receive from them all information relative to the meetings and excursions. Also, that all the papers which fall within the scope of the sections, and which may be prepared by the members of the Institute to be read at the special general meeting, and which would really include nearly all classes of papers, would be read before the sections of the British Association, and afterwards discussed at the usual generaal meetings of the Institute, and printed in their Transactions. If any of these papers did not fall within the scope of the sections, these could be read on the Saturday after the closing of the meetings and excursions of the British Association. He hoped that these arrangements would have the effect of inducing many of their distant members to attend the meeting of the British Association, who might not otherwise have done so.

SAFETY OF THE DAVY LAMP GAUZE.

The President then introduced the subject of the "Safety of the Davy Lamp Gauze," to which he had briefly alluded at the last meeting. His attention had been drawn to the subject by Mr. Greenwell, who had visited a colliery where they were in the habit of heating all their lamp gauzes red-hot previously to using them, to prevent their "exploding the gas should they become red-hot in an inflammable mixture." The subject was one of very deep importance, and he (the President) had since made one or two experiments, by inserting new lamp gauzes into the interior of a short red-hot pipe, when explosions occurred from volatization, and subsequent inflammation of the oil attached to the gauze. He had tried, in a similar way, gauzes which had been thoroughly cleaned and brushed, and also others after having been steeped in and thoroughly washed with stony solution of alkali, and the same results followed. It seemed to him, therefore, probable that the oil was contained in the pores of the iron itself, introduced probably in the process of wire drawing. He thought that the subject should be thoroughly investigated. Several explosions had occurred where safety lamps were in use, and which had never been satisfactorily explained. Careful experiment should be made further to prove the liability of a red-hot gauze to explode an inflammable mixture, and the circumstances under which this could occur; and if it be found that this liability really does exist, then remedial measures should at once be sought for, and adopted. Some years ago, he (the President) made several experiments on the safety lamp, the results of which had appeared in their Transactions. The gas was on several occasions exploded by putting the lamp rapidly through it, after the gauze had attained a high temperature; and it was quite possible that the explosion was caused by the co-operation and subsequent ignition of the oil attached to the gauze, and not to the passage of flame through the meshes of the gauze; it would be well if these experiments were repeated to determine this. He thought the matter might very properly be left in the hands of the "Experimental Committee" to arrange and carry out the necessary experiments; of course, any other member who might wish to be present at the experiments could attend.

A resolution to this effect was then agreed to.

VENTILATION OF THE HIBERNIA COLLIERY.

The discussion on Mr. Atkinson's paper, "On the Comparative Efficiency of Two Modes of Ventilating the Hibernia Colliery in Prussia," was then opened.

The President explained that the Hibernia Colliery was situated in the Ruhr Valley, in Prusssia, and the seams there lay at a very great angle, and are much distorted. The Inspectors of Mines in Prussia had desired the proprietors of this colliery to drive an extensive level stone drift from the extreme side of the workings, so as to carry the return air into the shaft at this level, in place of bringing it down to the level of the ingate of the upcast shaft. His (the President's) opinion had been taken professionally, and it entirely concurred with Mr. Atkinson's, whose valuable calculations would be laid before the Prussian authorities. It should be borne in mind that on the Continent the minerals all belonged to the Goverment, and the Inspectors of Mines thus acted as lessees' agents, and took cognizance of the methods of laying out and working the collieries, as well as of their safety.

COAL-CUTTING MACHINE.

The discussion on the paper "On Messrs. Donnethorpe, Firth, and Hedley's coal-cutting machine," by Messrs. John Daglish and Lindsay Wood, then followed. The President stated that this mode of working coal deserved attention and investigation; he hoped that some of the coalowners in this district would take the matter in hand.

—Mr. Atkinson, inspector of mines, alluded to the very brilliant sparks given off by this machine, when the pick came in contact with the iron pyrites; this should be investigated.

VENTILATION OF UNDERGROUND BOILERS.

A paper on this subject, by William Armstrong and John Daglish, was then read, of which the following is an abstract:—

In a previous paper, the subject of supplying "Ventilating Furnaces" with intake instead of return air was brought before the Institute, and instances were given where its application had been attended with marked success. Under certain circumstances, however, as where high shaft velocity obtains, there are objections to its universal introduction. These objections, however, do not apply to underground boilers, their fires must be supplied with air of a higher relative density, in order to obtain a powerful draught. Numerous experiments prove that, under the ordinary application, nearly 10,000 cubic feet of intake air are required for the efficient supply and ventilation of each boiler, distributed as follows—viz., 2,000 cubic feet below and through the fire, 1,000 through the coolers on either side of the boiler, and 5,000 through the boiler-house; of these only the first 2,000 are absolutely required, at the higher density, for the purpose of inducing rapid combustion. The writers advocate placing the boiler in the return; and allowing the return current free access over and around the boiler and coolers, and confining a current of intake air by means of pipes, entering below the fire, where its higher density would be required. This method is now in successful operation. In some of the larger and deeper mines, in which as many as five boilers are employed, the saving of even 5,000 cubic feet per minute per boiler would be attended with most beneficial results to the ventilating current of the mine.

C. W. WILLIAMS'S IMPROVEMENT IN STEAM BOILERS.

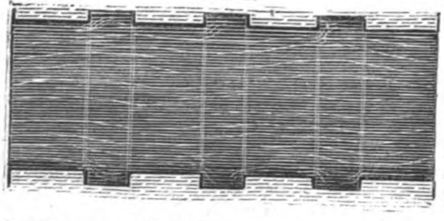


Fig. 1.

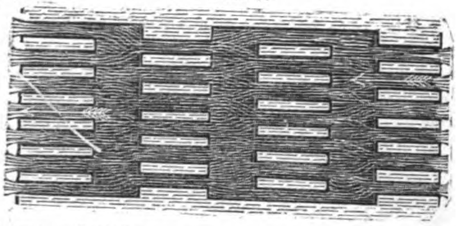


Fig. 3.

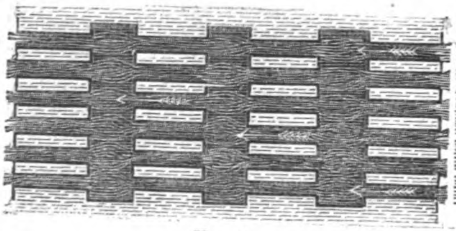


Fig. 2.

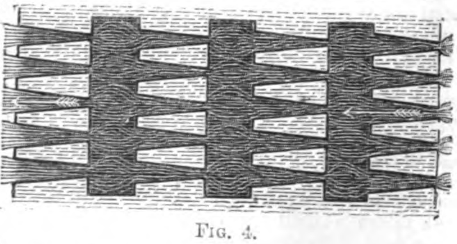


Fig. 4.

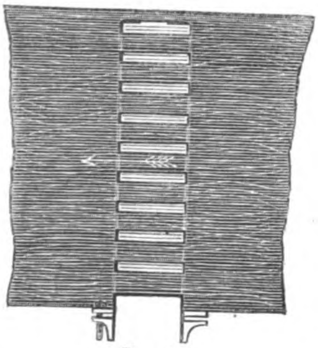


Fig. 5.

C. W. WILLIAMS'S IMPROVEMENT IN STEAM BOILERS.

A **patent** has been obtained by Mr. C. W. Williams, of Liverpool, for an improved means of increasing the evaporating effects of steam boilers. The invention consists in substituting for the ordinary long tubes or flues employed in locomotive, marine, and other steam boilers, sets or series of short tubes or flues of a circular, rectangular, or or other form, at short distances apart, each set or series being fitted into tube plates or face plates like those into which the long tubes aforesaid are inserted. The object of this arrangement is to increase the number of tube plates or face plates against which the flame and hot gases generated in the furnace strike, as in ordinary boilers. The tube plate or face plate surface, exposed to the direct action of the flame and hot gases, is much more efficient than the interior surface of the tubes themselves in transmitting heat to the water within the boiler.

The invention will be better understood on reference to the accompanying engravings. Fig. 1 is a plan of a series of these short tubes, each of which is about two to four inches in diameter, like ordinary tubes, but only eight to ten or twelve inches in length or thereabout, according to the space allowed for their insertion. Each series of tubes is inserted into and between two vertical face plates. Thus the heated current from the furnace passing through one set of these short tubes strikes with a direct action against the next face plate in which the second series of short tubes is inserted, and so on in succession through the remaining series, whatever may be their number.

In place of circular or cylindrical tubes, a series of rectangular short flues may be employed, as shown in fig. 2. Each series of flues is inserted between two face plates, as above described with reference to the tubes. There are spaces between the several series of flues or tubes, and which spaces in succession are open to receive the current of heated products from the furnace, the current from one set of such tubes or flues crossing this space and striking with direct action against the face plate in which the succeeding series is inserted, and so on. In the case of short boilers, where it is necessary to take up the heat in the shortest time and space, and with the view of enlarging the heat-receiving area of each succeeding face plate, the tubes or flues are made of a cone or tapered shape, instead of cylindrical or parallel, thus enlarging the orifice of the outgoing current from each tube or flue, and the heat-receiving area of the face plate against which the heated current is to strike.

Fig. 3 represents a portion of a boiler fitted with cone-shaped or tapered tubes or flues.

In furtherance of the same object, and particularly in short boilers, the several series of such tubes or flues may be so placed that the exit end of each, instead of being opposite and in the direct line of the succeeding tube or flue, shall be opposite the part of the succeeding face plate which intervenes between its tubes or flues, by which means each current of heated products is caused to strike the portion of the next face plate between the receiving ends or orifices of the next succeeding series.

Fig. 4 is a plan of a series of indirect tubes or flues. With the view and for the purpose of facilitating the process of cleaning, repairing, or otherwise, each series of tubes or flues form a distinct and separate vessel, which may be removed or replaced at will, as represented at fig. 5.

BROOMAN'S BORING APPARATUS.

Mr. R. A. Brooman, of 166, Fleet-street, has recently obtained a patent on behalf of M. Leschot, of Paris, for a tool for boring and apparatus for working the same. The invention consists in the construction and employment of tubular tools armed with diamond cutters, to which rotary and advancing motions are communicated. The tools consists of metal tubes with a ring of iron or steel at the working end, into which diamond cutters are fitted; the tube is connected to a shaft by a bayonet joint or otherwise. On rotary and advancing motions being communicated to it, it bores or cuts a circular aperture in the rock, stone, or other material acted on, and receives within it a core or bar of such material, which is afterwards removed. A caoutchouc pipe may be connected to the tube for forcing in water to remove the detritus.

The apparatus for working the tool is mounted upon a carriage on wheels, or on a bed supporting standards, in which bearings are formed for receiving the shaft to which the tool is fitted. Rotary motion is imparted to the shaft through a toothed wheel gearing into a pinion on the driving shaft, which has motion communicated to it from a crank pulley or otherwise. The advancing motion is communicated through a wheel on the crank shaft communicating motion to another wheel on the tool shaft through the agency of an intermediate wheel; one end of the tool shaft is threaded, so that while it revolves the screw at the same time imparts a forward motion to it. For convenience the carriage may run on rails, and may be secured to them by grippers fixed to the carriage.

According to the work it is to be put to, the boring tool may be single or multiple; that is to say, any number may be fitted on one frame, being so arranged as to work at all angles and in all directions, parallel, convergent, or divergent. Motion may be communicated by hand, steam, or other power.

The engravings show the manner in which the simultaneous rotary and forward movements are effected, taking, by way of example, a machine with only one boring tool.

Fig. 1 is a longitudinal section, and fig. 2 a cross section, of a boring tool constructed according to this invention. *a* is a tube of steel or iron, or other metal; *b* is a ring, or crown, carrying on its face several cutters *c*, *c*, being diamonds. This ring is changeable, that is, one ring may be removed and another supplied in its place; it is fixed on the tube by a bayonet joint or otherwise. The tube *a* is supported in bearings, and receives continuous rotary motion through suitable gearing on the driving shaft. The tube has also an advancing motion imparted to it.

Fig. 3 represents an arrangement in which the tool is fixed to a socket moveable round the vertical upright, and capable of being raised or lowered to enable it to be worked at all heights; by means of three bolts, the conical heads of which slide in a circular groove or slot, the tool may also be inclined to bore holes at any angle or in any direction.

The apparatus may be fixed to the frame mounted on a carriage on wheels or roller; the carriage may be secured on rails by grippers, as shown in fig. 4, or in any other convenient manner. At each turn of the tube *a* the cutters *c* bore or cut a circular aperture in the rock or other material acted on, and a core or bar of the material is received within the tube, and is afterwards removed, the tube advances a distance determined by the pitch of the screw thread and by the relative motions of the wheels. A caoutchouc pipe is connected to the threaded end of the tube for forcing in water to remove the detritus, without which the tool would become choked, and channels or grooves may be formed on the exterior and interior surfaces of the ring *b* to facilitate the passage of the water.

Fig. 5 represents an arrangement suitable for

BROOMAN'S BORING APPARATUS.

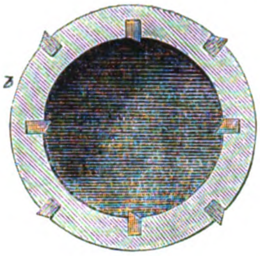


FIG. 2.

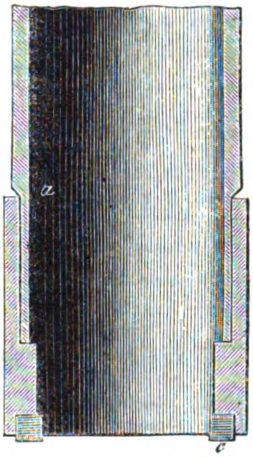


FIG. 1.

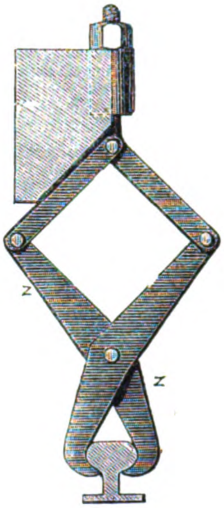


FIG. 4.

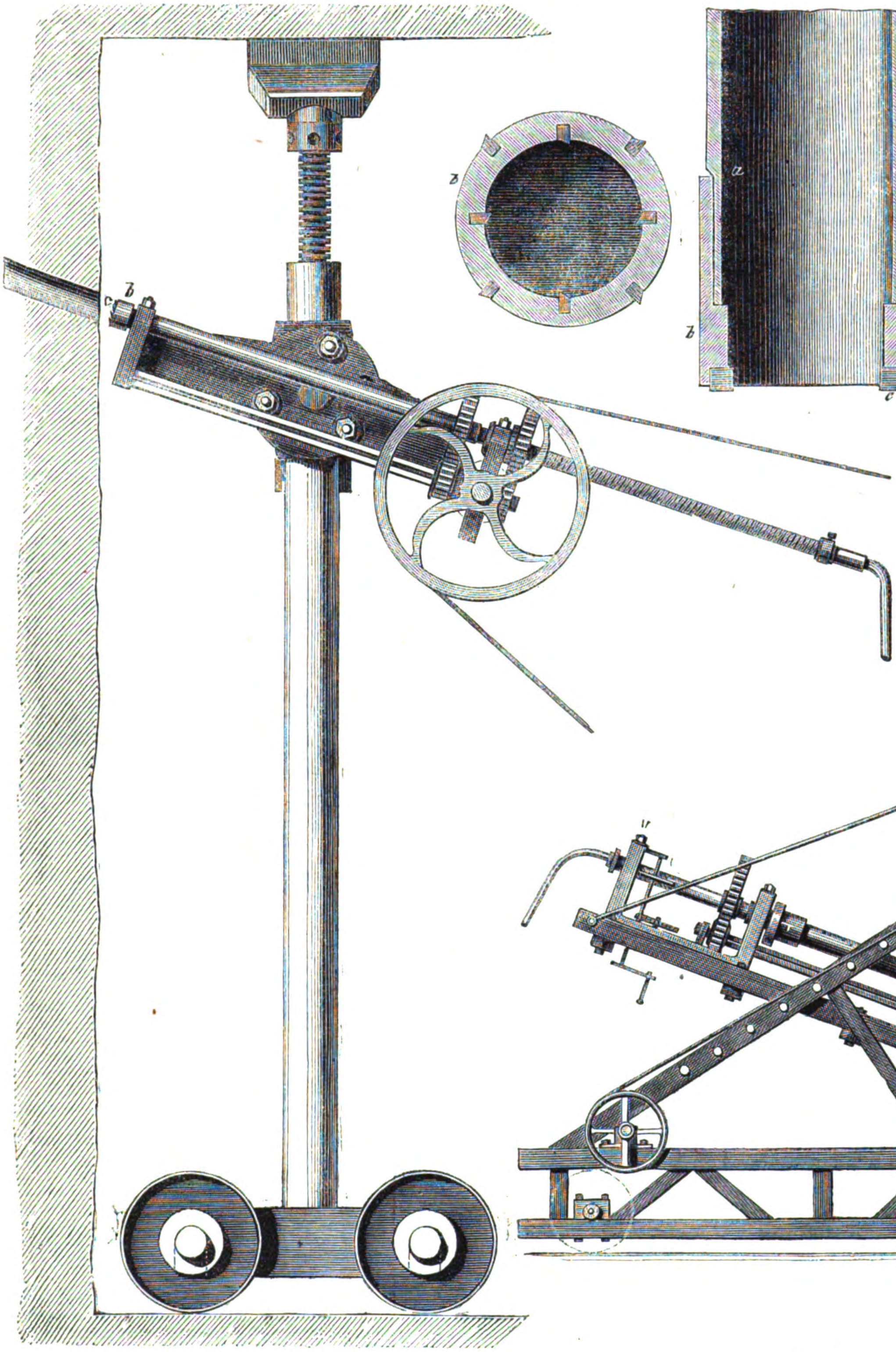


FIG. 3.

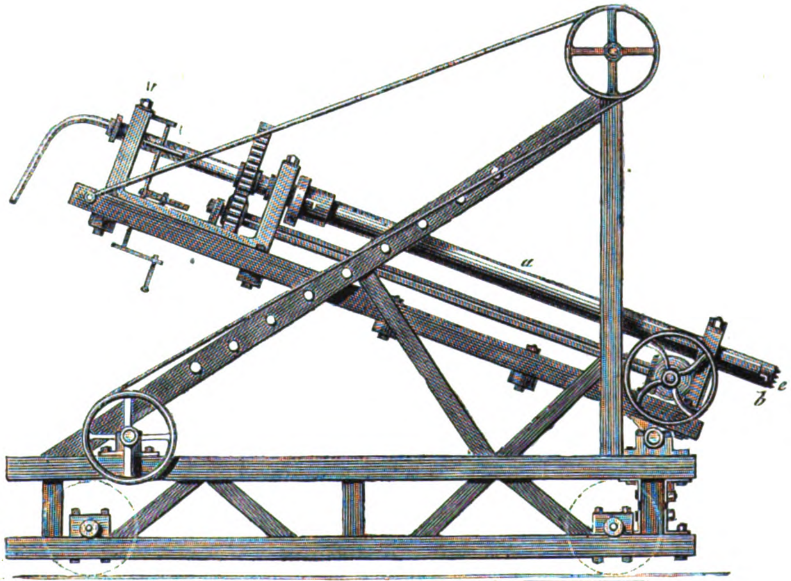


FIG. 5.

boring deep holes of large diameter and in any direction. The motion is imparted by a crank or by a belt passing over a pulley, which, through gearing, gives rotary movement to the tool. The tube *a* has a threaded prolongation fixed to the frame *v*, carrying rollers. The threads communicate rotary movement through toothed gear to a pinion gearing into a rack extending the whole length of the wooden frame which supports the apparatus; the frame *v* thus receives an advancing motion, which it transmits to the tube and cutters. This arrangement allows of the variation of the inclination of the tube.

At a recent meeting of the Franklin Institute, Philadelphia, Mr. Thomas Shaw exhibited a specimen of fractured glass tube, the peculiarity of which consists in the line of fracture, which is in the strongest direction, and instantaneous throughout the whole length, from 10 to 15 ft., without any apparent cause. This does not occur with tubes made in shorter lengths, other conditions being the same. He attributes the cause to the mode of straightening the tube, which is done in this wise. After the tube is drawn out sufficiently, it is held suspended in the air, and revolved until sufficiently cool to permit no further bending. It will be observed that this continual bending, which the above operation causes, must necessarily bring the glass to a state of *torsion* in the direction of the fracture. He has since had tubes made of the same length, in the usual manner, with the exception of cooling and straightening them upon a flat surface, that are free from this evil.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Correspondents who wish their manuscripts to be returned are requested to say so.

RECEIVED.—W. M.—M. A. (answered by letter.)—V. P.—A. B.—A. G.—Capt. N.—Ed. W. B.—C. G. B.—T. G.—Com. O.—W. A.—J. V. P.

J. A. H.—The MECHANICS' MAGAZINE and BUILDING NEWS shall be sent regularly.

E. W. B. (Manchester.)—The Magazine is sent regularly. Does the irregularity arise from the local post-office?

J. B.—Thanks for the offer. We have made it a point not to co-operate with patentees in such matters.

TYRO.—The best work on locomotives is Mr. D. K. Clarke's. It is published by Blackie and Sons, and it costs about £4 10s.

G. M.—We know of no good work on the subject.

T. S. (Sheffield).—We cannot insert your request. You can purchase some loadstone at Knight's, Foster-lane, Cheapside. You could make a magnetic composition by the use of processes that are described in most works on chemistry.

J. B.—There is no tannin in oak wood, it is only present in the bark. There is a very small quantity of tar in the wood, but the cost of its production would exceed its intrinsic value.

T. C. (Chowbent).—Supposing that the person you allude to has really described something in his specification which has already been covered by your patent, that in itself does not constitute an infringement. Even if the machine or part of the machine patented by you were actually made for *experimental* purposes, this has been ruled, according to the case of Jones *v.* Pearce (Webster's Patent Cases, 125), to be no infringement. If, however, the party employs others to make machines according to your patent, and sells such machines, or himself makes and vends such apparatus, it is an infringement, and you can proceed against him as the law directs.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

◆

SUBMARINE TELEGRAPHY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In my last letter, in its second paragraph, Ireland has been misprinted for Iceland, as I have little doubt would occur to all who read it.

With reference to Captain Selwyn's remarks on my proposition for surface telegraphy, it humbly seems to me that the difficulties with which he surrounds it could all be avoided. But I shall first allude to what he says about the alleged undoubted existence of *under* currents in the ocean. And I shall commence by quoting from Maury's own book a fact recorded in it extremely hostile to the truth of the existence of such *under* currents:—"In confirmation of these views as to the existence of a cushion of still water at the bottom, I bring in for farther evidence the testimony afforded by Commander Dayman, R.N., while running his line of deep sea soundings along the telegraphic plateau, in H. B. M. S. 'Cyclops.' On one occasion he hauled up from the bottom a coil of 200 fathoms of deep sea line. It had been laid at the bottom round and round in a coil, with as much regularity as it could have been coiled on deck by hand, thus showing either that there was no current there at all, or that the upper and under currents so nearly counteracted each other that the line passed perpendicularly through the still water."—Chap. 21—"The Atlantic Telegraph."

Now what do we find here? Not merely what Maury says, "a cushion of still water at the bottom," but, if I may be allowed the expression, a cushion of still water all the way from top to bottom; for his alternative about an alleged upper and under current compensating each other so exactly as to produce the result in question, is a most gratuitous, and, in the circumstances, an utterly incredible idea. But, enamoured as Maury is of his under-currents, he could not bring himself to dispense with their existence, and hence the alternative. Now the simple, clear, conclusive fact recorded by Commander Dayman ought, with all truly scientific minds, to raise the greatest doubts of, if it should not altogether abolish, the idea of under currents. And with such a significant fact against their existence, I must beg leave, with all respect, to decline adopting Captain Selwyn's assurances—which, at any rate, are far too sweeping to be relied upon—that they exist. Air, no doubt, has under currents; but water is about 800 times denser than air, and its particles have much more friction on each other, and, consequently, are vastly more sluggish and immoveable, and, therefore, in my humble opinion, the ocean can have no under currents. To reason that because air has under currents water must have them also, is utterly ridiculous, and disgraceful to the science of the nineteenth century. There is as much, or more, alliance between solid matter and water, than between air and water. And it will yet be finally established that, while the ocean resembles air in having currents on its surface, it resembles the dry land in having no currents in its depths; thus holding in its action, as it does in its nature, an intermediate position between the two. Of conrse, when a volcano breaks out at the bottom of the sea, there will be ascending currents of water. But this is a rare and restricted kind of action, and not what Maury means by under currents. Capt. Selwyn says—most inconsistently it seems to me, according to his own ideas—"the greater the depth the less disturbance probable from this cause (under currents) at or near the bottom." I beg leave to ask him most respectfully—why? I may further remark that I take up your space with less reluctance on this point because, whatever may become of my proposition, it is desirable on every account that the groundless—the unscientific—idea that under currents exist in the ocean should be eradicated, as false ideas are always hostile to improvement in some shape or other.

Captain Selwyn states other objections to surface telegraphy, involving, chiefly, the mechanical difficulties in constructing the line. These, of course, I at once admit are real difficulties, and not imaginary, like the one we have just been discussing. But they seem to me to be all easily surmountable.

He appears to think that only one ship could be employed in mooring the buoys and in laying the telegraph cable. But there could and would be two at least—one to moor the buoys, the other to lay the cable.

He seems to apprehend much danger to the telegraph cable, as far as I understand him, from its own weight. Now it is to be made of very slightly more specific gravity than sea water—enough to make it sink, and nothing more—so that it would scarcely have any weight at all.

He seems to doubt if the chains, or other means to retain the buoys in their places, would be strong enough at two miles depth to support themselves. I see no reason to doubt it, considering that there would be no foreign strain upon them.

When I said that the telegraph line would be accessible for repair, it involved that it might be under-run from buoy to buoy; and nothing the captain says impugns this, though he starts some rather intangible objection to it.

As for the experiment the captain proposes I should make, it is ingenious, but would not be conclusive as regards the ocean and a telegraph line so light as is proposed to be made; but even though it were conclusive, as to the line touching the bottom of the ocean, there would still be left a large balance of advantages in favour of my plan as regards any route, but more especially if the Northern route is adopted with all its special advantages.

I have thus (as briefly as I could with reference to your space) answered generally Captain Selwyn's objections; to whom, whatever be the result, I feel greatly obliged for the trouble he has taken or may take with my views. H. K.

Edinburgh, April 13, 1863.

ATLANTIC TELEGRAPH.

SIR,—Circumstances prevented me at the time answering "H. K.'s" invitation to criticize his scheme for laying a Telegraphic Cable to America by means of supporting buoys, &c., as contained in your number of March 27th; but, perhaps, it will be satisfactory to him to state that I perfectly agree with Captain Selwyn in the impracticability of the scheme.

I had made a few notes on "H. K.'s" letter, in which I had, for the sake of argument, dismissed the subject of currents altogether, and endeavoured to prove, from the insuperable difficulties attending the placing of the buoys in such deep water, or even in ascertaining the depth to within the number of fathoms he proposed to submerge them, it would be impracticable,—also the little effect the buoys would have in supporting 300 or 400 miles of cable, for although we have a cable sufficiently light (Duncan's Ratan) to float if necessary, still it is not probable that even that cable would remain at the same specific gravity as when laid, but from the accumulation of weed, barnacles, &c., would gradually get heavier and sink, so that the weight on the buoys would gradually increase till they would be dragged so far down that the enormous pressure would cause them to collapse; so that "H. K." like the person to whom the Dutchman proffered one hundred reasons for not firing a salute, the first being that he had no powder—the other ninety-nine were excused—must rest satisfied that, as it is impracticable to lay his buoys, no other argument need be entered into, and that "for weal or for woe" an Oceanic Telegraph Cable must lie on the bottom.

And now, Sir, allow me to examine a little into the nature of the arguments advanced as reasons why a cable should not lie on the ground, because I cannot but think they are difficulties rather imaginary than real. "H. K." has stated his arguments as being—

1. The thorough inaccessibility of the cable laid at such a depth for repair;
2. The pressure of the great superincumbent mass of water; and—
3. The utmost uncertainty as to the suitability of the bottom for the cable.

In answer:—The first is the only one tenable; and although cables have been raised from great depths and repaired, still, I believe, that to raise an oceanic one from 2,000 fathoms to be perfectly impracticable, or, if done, the cable would be so injured by the act that the remedy would prove worse than the disease.

2. There is no pressure of the superincumbent mass of water; but, like the pressure of the air on our bodies, it would be equal on all its parts, so that if a cable is well made, the great pressure to which it is subjected would tend rather to consolidate its parts than to injure it; but the effect could be easily tested by placing a portion of cable, hermetically sealed at the ends, in a hydraulic press and subjecting it to a pressure of 500 atmospheres (which would be more than equal to any pressure at the depths between this and America), and examining it afterwards. If, as is stated, by being submerged at those great depths the conductor loses in electrical conduction, it is a case for the electricians to study, and a difficulty to be overcome, for lie on the ground it must—at least, such is my humble opinion.

The third objection is the one most often quoted—viz., the suitability ofe th bottom for the cable. Strange as it may seem, I do not think it signifies what the nature of the bottom is on which an oceanic cable is to lie (I allude, particularly to the deep water—near the shore it it is of vital importance). Several Admiralty pamphlets on deep sounding (obtainable at Potter's, Poultry), will prove that a heavy weight, dragging a small line *vertically* through the water, reaches the bottom at 2,000 fathoms so slowly, that to persons on the surface it is difficult to determine the minute of contact; if such be the case, how very gently must a cable 1½ or 2 in. in circumference, reach the same depth when laid horozontally along the surface of the water and allowed to sink with its own gravity to the bottom? It is generally allowed, from the evidence of the minute and perfect formations brought to the surface from these great depths, that the water at the bottom must be in a state of perfect quiescence, therefore no abrasion from its movement need be feared; so that, considering the density or specific gravity of the water at the depth the cable must fall and lie as lightly on its bed as a feather on the surface of the earth; and even supposing the cable did not take up the inequality of the ground, but hang in a bight from one point of rock to another. My firm belief is (for the reasons stated), that it would not receive any injury as long as no attempt was made to raise it.

I do not pretend to high scientific acquirements. I merely give an opinion, and state the reasons on which I ground it. Those who feel an interest in the subject and study the question, are the best judges if they are sound. I am, however, pleased to find that some grant me the meed, denied by Dr. Wallich, viz., of writing common sense, and even endorse my opinions with their names; but Dr. W. seemed more annoyed at my preserving my incognito than anxious to support his theories or controvert my arguments against them; but if he wishes to know me personally I will tell him when and where I will introduce myself—it will be on the occasion when he propounds his next scheme before the Royal Geographical Society at Burlington House.

I am, Sir, yours, &c.,

AN OLD SAILOR.

VELOCITY OF PROJECTILES.

SIR,—Permit me to draw your attention to some apparent inaccuracies in the first article of your issue of April 3rd.

The effective force of Whitworth's projectile is stated in the 1st col. as 21.06; in the 2nd col. 22.06. Moreover, the effective forces measured as there indicated "by multiplying the weight into the square of the velocity," would not be—

Whitworth.	Armstrong.	L. Thomas.
21.06.	22.13.	22.29.

as there stated, but—

Whitworth.	Armstrong.	L. Thomas.
22.75.	21.60.	22.14,

if 1,215 ft. per second be assumed for the latter.

I annex the calculation :—

```
Ft.        1240              1470              1215
            1240              1470              1215
          ───────           ───────           ───────
           49600            102900              6075
          2480               5880               1215
         1240               1470               2430
                                              1215
          ───────           ───────
         1537600   .       2160900            ───────
lbs.         148               100            1476225
          ───────           ───────                150
        12300800     21.60 | 90000            ───────
        6150400                              73811250
       1537600                              1476225
     ───────────                          ───────────
     22.75 | 64800                        22.14 | 33750
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OBSERVATOR.

MACHINE BELTING.

SIR,—In your number of March 20th, speaking of Mons. Roullier's patent machine belts, made of small links of leather, united in the form of a chain by joint-pins, you say:—"It appears to us that an objection will be found in this belting from the fact that there is necessarily a tendency in the joint-pins to bend to the curve of the pulley, and a continuation of this action would naturally lead to a breakage of the joint-pins." I enclose you a sample of the belt, by which you will see that as the pins lie across the pulley at right angles with the length of the belt, it is impossible that they can bend—indeed, so far from being liable to this objection, I have these bands superior to the ordinary kinds (on account of their perfect pliability) for places where it is necessary to use both surfaces. Even if the faces of the pulleys are made slightly convex, this objection would not hold good, as the spring of half an inch for a piece of wire a foot in length (which is the proportion in which the rims are curved) would not tend to damage it at all. I have seen specimens in Paris which have been in constant use for twelve months, and are not at all affected.

As I am the sole licensee and manufacturer of these belts for this kingdom, and as any deprecatory remarks of yours, owing to the widely-spread circulation of your MAGAZINE, are calculated materially to injure me, I trust to your sense of justice to insert these few lines in your valuable journal.

I am Sir,
Your obedient servant,
W. T. ROWLETT.

Leicester, April 13, 1863.

PATENT LAW REFORM.

SIR,—The question of "Patent Law Reform" admits, I think, of a few additional observations before I lay my scheme before your readers. Some topics yet remain, which may, as it seems to me, be advantageously noticed before we come to a scheme. The report of the Commissioners is now, I believe, speedily expected; but it is doubtful whether any measure will be matured this Session. The subject is one which certainly requires care and consideration on the part of the Legislature. A hasty and inconsiderate reform will only add to existing difficulties.

This letter I devote to the consideration of the two following points, viz.:—

1. The present duration of a patent
2. The necessity for a preliminary investigation.

1. *The present duration of a patent.*—This, no doubt, is a serious consideration to our inventors. Some, I believe, think that the difference between a patent and copyright is unjustifiable. Though it may be somewhat difficult to answer this question, the analogy is not, I think, identical. A letter like the present does not obviously admit of a lengthened discussion of such a topic. The report of "The Inventors' Institute," deals, I think, ably with this subject. On the whole, it is, I think, worth consideration, whether the duration of a patent might not judiciously be extended. However, the present powers of extension must not be overlooked. If the present period should be extended—say to 21 years—such period should, I suggest, be absolute, and the powers of extension be taken away. On the whole, I doubt whether the present regulations can substantially be improved.

2. *The necessity for a preliminary investigation.*—This is certainly a branch of the subject that requires the Commissioners' serious attention. The interests of the inventors and the public are obviously involved in this question. At times I have thought, as I candidly acknowledge, a preliminary investigation desirable. Much, no doubt, can be urged on both sides, but it is difficult to "balance the scales." It must be admitted, I apprehend, that patents for very trifling inventions are frequently taken out. In some instances, these inventions consist of little better than what are known as "mechanical equivalents." My impression is, on the whole, that this is one of many subjects for which it is impossible to legislate satisfactorily. The ideas which spring up in a man's mand are frequently traceable to a *chinic origin*, and are what we may call "instinctive ideas." These are commonly adapted to the peculiarities of an age for which Providence is making special provision. Great danger would, I feel, attend the suppression of such ideas, however occasionally desirable to check ridiculous patents.

These views, Sir, I submit to your readers, but with deference and respect. The Commissioners would, as I suggest, receive much assistance if there was a larger expression of public opinion. Allow me to press this on the attention of your readers.

I am, Sir,
Yours very obediently,
J. CULVERHOUSE.

3, Compton-street, Ball's-pond,
April 15, 1863.

REVOLVING CUPOLAS.

SIR,—I do not pretend to know anything about iron ships, but I cannot see why the revolving cupolas should not be made square or (better still) triangular, with the port or ports at the corners. I presume that the guns would be pointed at the enemy, in which case shot could only strike it at an angle, unless, indeed, by good luck they struck the knife edge, and that would be by far the strongest part of the cupola.

Whether this suggestion is of any value I leave to you.

Believe me, Sir, yours sincerely,
Woodbine-cottage, Sidmouth, C. C.
April 15, 1863.

FOG SIGNALS.

SIR,—With reference to your article, "Fog and Fog Signals," April 3rd, 1863, I would suggest that there would be little difficulty in constructing buoys with self-acting whistles, on the principle for which my father took out a patent sometime between 1830 and 1832—namely, by loose floats hinged on to] the buoy, and working an iron rod lever, which might either press on an elastic, so as to sound a whistle with every motion of the waves, or to accumulate air in a reservoir till it had attained sufficient force to overcome a loaded valve, and thus give out a louder sound, not much inferior to a whistle sounded by the escape of steam.

I am sir, your obedient servant,
CHAS. BATHOE.

28, York-place, Portman-square,
11th April, 1863.

SIR,—Having noticed your observation on the comparison made between the "Stethoscope and the Steam Engine Indicator," in your review of Mr. Hopkinson's work, it may not be amiss to remark that Mr. D. K. Clark made the same comparison in his introductory preface to "Railway Machinery," in 1855. Referring to the application of the indicator to locomotives, he described that instrument "as a sort of stethoscope for testing their physiological condition." A. B.

London, April 11, 1863.

MECHANICAL MOTIONS.

SIR,—In your review of my work on Mechanical Motions, you state that the Sun-and-planet and Whitworth's variable motions are not described. The former is described in plate 5, fig. 16; the latter, plate 8, fig. 18.

Mr. Whitworth's name is not mentioned in my description, because his invention was (I believe) the application of the motion to planing machines.

Referring to your concluding remarks, you will find on closer examination that the number of well-known motions forgotten or left out, to be far exceeded in number by those described therein for the first time, which I think is of greater importance. I am, &c.,
JOSEPH WILLCOCK.

Meetings for the Week.

MON.—*British Architects.*—At 8 p.m.
United Ssrvice Inst.—"On Steering and Manœuvring Ships with Broadside Batteries by Twin Screw Propellers," by Com. T. E. Symonds, R.N., at 3.30 p.m.
Medical.—At 8.30 p.m.
TUES.—*Inst. Civil Engineers.*—I. Discussion upon Mr. Brunton's Paper "On the Scinde Railway." II. "Account of the Coffer-dam, the Syphons, and other Works constructed in consequence of the Failure of the St. Germain's Sluice of the Middle Level Drainage," by Mr. Hawkshaw, at 8 p.m.
Royal Inst.—"On Animal Mechanics," by Prof. Marshall, at 3 p.m.
WED.—*Soc. of Arts.*—"On the Construction of Twin-screw Steam-ships," by Capt. T. E. Symonds, at 8 p.m.
THURS.—*Royal Inst.*—"On Geology," by Prof. Ansted, at 3 p.m.
Antiquaries.—At 8.30 p.m.
Civil and Mechanical Engineers.—"On Marine Surveying," by Messrs. F. E. Cooper and G. J. C. Dawson, at 7.30 p.m.
Royal Soc.—At 8.30 p.m.
FRI.—*London Inst.*—"Economic Botany," by R. Bentley, Esq., at 7 p.m.
Royal Inst.—"On Luminous Meteors," by Alex. S. Herschel, at 8 p.m.
United Service Inst.—"On the Progress of Military Science during the Year 1862," by G. R. Burnell, Esq., at 3 p.m.
Architectural Assoc.—Class of Design—Dairy.
SAT.—*Royal Inst.*—"On the Science of Language," by Prof. Max Müller, at 3 p.m.

Miscellanea.

The total number of workmen now employed upon the "Royal Sovereign" turret-ship at Portsmouth is nearly 300, additional hands, we are glad to observe, having been placed upon her within the last few days. Her plating is now being carried on rapidly, and the cylinder or hollow pivot of her foremost turntable and turret is in its place.

A gang of upwards of 80 convicts are now employed in No. 10 dock at Portsmouth, in chipping off with scrapers the composition and rust from the two lower tiers of armour-plates on the sides of the "Black Prince" iron frigate. The oxidation on the surface of the plates amidships has been considerable in the wash of the water-line, as must naturally be the case with slabs of iron only protected by paint or patent compositions.

Mr. Arthur Gearing will deliver a lecture on a new system of artillery adapted to the modern requirements of the Navy, at the United Service Institution, on the 20th inst., at half-past 6 o'clock p.m. The object appears to be, to first establish the expediency of determining the characteristics of the gun best suited to the Navy under the altered conditions of modern warfare. It being conceded that the "fleet of the future" can only be accurately determined by the ascertained practicability of the "guns of the future," consequently *relative* ultimate economy and efficiency are involved in this vital consideration of the subject.

Mr. James Bruce writes to us to say that he has discovered a new fibre, which, for "stuffing beds," has been pronounced by the leading firms of manufacturers and upholsterers, &c. (to whom it has been submitted), as superior to cotton, wool, flock, prepared rags, velvet cuttings, &c., for the above purpose. It is of the most delicate texture, not liable at any time to knot or decay, free from smell and dust, and, moreover, very abundant and cheap.

The Americans have discovered a new method of loading their rifles and guns, which has two advantages—that of economizing time and saving money. The bullet and ball have the powder ready adhering to them, and over that is laid a thin layer of gum, keeping it compact and dry; thus neither cartridges nor paper are necessary, and only half the usual time for loading required. It is said to have answered so well that the French Government think of adopting the method.

An American has invented a lock umbrella stand. The moment the umbrella drops to its place in the rack the handle is by a single movement grasped and held firmly in the clutch of a lock which nothing but the key specially manufactured for the particular depository can loose. The key, which is practically a pawn ticket for the article, is of less weight and no greater size than a nickel cent, and adds no perceptible weight to the vest-pocket. The invention is at once ingenious and useful. Its introduction into counting rooms, hotels, offices, and halls, and other places of public and private resort, must become general.

The Admiralty have entered into a contract with Messrs. Campbell and Johnston for the erection of a new crisson at the entrance to the second dock at Chatham, in which the iron frigate "Achilles" is under construction. The cost of the new caisson is estimated at £3,500. Directions have likewise been received at Chatham for the erection of a new boiler-house at the "Achilles'" workshop for the reception of the new machinery which is ordered to be purchased and erected during the present year. Among the sums voted for the expenses at Chatham dockyard during the current year is one of £16,480 for wages for 480 additional hired mechanics and artizans to complete the work already in progress at that establishment.

During the month of March two hundred gold, silver, and copper mining companies were formed in San Francisco to develop the mines in California, Nevada, and North Western Mexico; their nominal capital was over eighty millions of dollars.

Austrian Gun Cotton.—Take cotton yarn and twist it into strands of suitable size to answer the same purpose as grains in gunpowder. (The size of these strands can only be ascertained by experiments.) It is then steeped for a few minutes in nitric acid contained in a stoneware vessel, squeezed, and thoroughly washed by water, which is permitted to fall upon it from a pipe set at a height of several feet. After this it is squeezed, and dried in a room heated to 130 deg. Fahr., when it is ready to be treated with a mixture of nitric acid of 1·52 specific gravity, and sulphuric acid of 1.14 specific gravity. These acids, in equal quantities, are mixed together in a glass or stoneware vessel, and allowed to stand for twenty-four hours, then the prepared yarn is immersed in it for forty-eight hours, with occasional stirring; the vessels being covered; then it is squeezed, washed for several hours in running water, and dried again. After this it is soaked for a short period in dilute silicate of potash, squeezed, washed again, dried, and is fit for use. This gun cotton is manufactured by M. Reny, of Vienna. It emits but little smoke, and is not subject, like common gun cotton, to explode by percussion.

Sketch of the Iron-clad "Chillicothe."—The iron-clad "Chillicothe," whose brilliant exploits on the Yazoo river have rendered her name familiar to our readers, was built at New Albany. She is 170 ft. in length, 60 ft. beam, and 7 ft. deep, and draws, when loaded, about 6 ft. of water. She has four boilers, high pressure of course. She was built for a thirteen knot boat, and has realized her builders' most sanguine expectations. She is completely mailed with 1 and 2-inch iron, and the turret, which is stationary, with sloping sides and shell-proof gratings overhead, is clad with a double wrought-iron plating, 3 in. in thickness, backed by solid oak 16 in. thick. Her armament is two 11-inch Dahlgren guns in the turret, and four 24-pounder howitzers in broadside. She has a house extending from the turret to the wheels, which is occupied as quarters for the captain and officers when not in action. There is also a full complement of rooms below. Her engine, boilers, and lower quarters are all protected by mailing. She has appliances for throwing hot water, in event of being boarded by the enemy. She has two immense and powerful capstans, to heave her over shoals and bars in the rivers where there is low water. She has been in commission only a short time, and her superior build and powers of resistance gave her the place of "head boat" in the expedition in which she now performs so gallant and bold a part.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2538, 2545, 2572.

Boilers and Furnaces, 2570, 2583, 2584.

Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2541, 2573, 2596, 2599, 2602.

Ships and Boats, including their fittings, 2561.

Cultivation of the Soil, including agricultural implements and machines, 2563, 2589.

Food and Beverages, including apparatus for preparing food for men and animals, 2543, 2594.

Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2547, 2558, 2559, 2564, 2568, 2575, 2585, 2592, 2593, 2595, 2600, 2601, 2607, 2608, 2610.

Buildings and Building Materials, 2540, 2548, 2562, 2577.

Lighting, Heating, and Ventilating, 2537, 2542, 2553, 2554, 2555, 2560, 2566, 2567, 2571. 2597.

Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2537, 2546, 2549, 2551, 2557, 2576, 2578, 2586, 2587, 2590, 2606, 2609.

Metals, including apparatus for their manufacture, 2569.

Chemistry and Photography, 2552, 2556, 2565, 2579, 2598, 2605.

Electrical Apparatus, 2574, 2591.

Warfare, 2544.

Letter-Press Printing, 2582.

Miscellaneous, 2493, 2550, 2580, 2581, 2603, 2604.

2537. J. Whines. *Improved machinery for filling dipping clamps with tapers and match splints.* Dated September 16, 1862.

The object of this invention is to facilitate the separation of tapers or match splints, of whatever form or material they may be made. On one side of the machine is a box or hopper with a series of divisions into which the tapers or splints are placed; at the bottom of this box or hopper is a slide with a series of grooves at one end running across at right angles. When the grooved portion of the slide is drawn under the box or hopper containing the tapers or splints, the grooves become charged therewith. At one end of the box or hopper, and immediately over the slide, is a toothed roller with recesses or grooves at intervals, into which is fitted a fender or check; by imparting with any suitable gearing rotary motion to the roller, that portion of the side charged with the splints or tapers is readily withdrawn from the box or hopper into a tube with guideways or grooves corresponding with the grooves in in the slide; the splints or tapers are now thrust out of the grooves in the slide, and through guideways into the dipping clamp, by a series of plungers connected to a reciprocating bar put in motion by a rocking shaft with levers and connecting links; to this bar are also secured two or more taper pointed rods, which may be either round or square, and which separate the boards to receive the splints or tapers between them, and cause the frame and boards to descend; the taper pointed rods are then withdrawn, and the boards which were on the upper side of them fall on to the row of splints or tapers just deposited on the lower board, and are kept from contact with each other by vertical guides. In front of the dipping frame is a guard to prevent the splints or tapers from being thrust farther than is necessary; this guard is provided with a moveable panel, which, after the frame is filled, is forced by eccentric rollers against the ends of the splints or tapers to put those which have been driven too far back again, after which two slips are withdrawn from between the dipping frame and the front of the machine, and the frame itself is forced by levers close to the front of the machine, thereby putting the ends of the whole of the splints in one plane. They are then screwed fast together, and the frame charged with the splints or tapers is removed for dipping in the igniting composition. *Patent completed.*

2538. B. F. Weatherdon. *A new or improved engine for obtaining and applying motive power.* Dated September 16, 1862.

This invention has reference to a new or improved construction of engine to be worked by volatile chemical agents, or similar fluids, capable of being readily converted into vapour and condensed by ordinary means at temperatures below the boiling point of water, by which great economy in the power, as also in the construction and wear and tear of the engine, is obtained, and consists in the cylinders and working parts of the engine being wholly enclosed, and caused to work within the boiler and generator, in such manner as to communicate direct rotary motion thereto, through the medium of a fixed shaft or axis, whereby all danger from leakage, loss of power, or otherwise, is obviated, and a more simple and compact form and construction of engine obtained than at present, toothed rack and segment wheels in some cases being employed in preference to the crank, together with steam or hot water jackets surrounding the boiler, either separately fixed, or made to revolve in in connection therewith, as also with condensers in like manner. *Patent abandoned.*

2539. J. G. Bunting. *A mechanical horsebreak.* Dated September 16, 1862.

In carrying out this invention, the inventor proposes to construct a horizontal framing somewhat in the form of a pair of cart shafts, the hinder extremities of which are left open for the entrance of the horse. These shafts are connected by means of an arched axle, the arch extending over and across the haunches of the horse, ordinary carriage or cart wheels being attached to the arms of the axle. The fore parts of the shaft rest on a fore carriage and wheels, to which is attached a pole or shafts for the purpose of harnessing either a single horse or pair. The object of this invention is, that an ungovernable horse may be harnessed within the frame or carriage, and be retained therein by means of bands and straps passing over his back and under his belly, and attached to each side of the frame or carriage, by which means he can neither lie down nor rise from the ground, harness being attached to the fore part of the framing, and also a collar strap, whereby the horse is securely held in position and compelled to follow the leader or leaders in the pole or shaft. *Patent abandoned.*

2540. G. L. Lee. *Improvements in the manufacture of shutters for shop fronts, doors, and windows.* Dated September 16, 1862.

In carrying out this invention, the patentee proposes to construct shutters of sheet metal, either plain, corrugated, fluted, or zigzag, in divisions or sections of any desired width, the edges thereof being turned over and doubled for strength, and also, if required, for the purpose of forming a rabbet joint to same. The shop front or window is to be provided with a groove or bar at the top and bottom thereof, and running the entire length of the window or front, so as to form a groove or rabbet into which the shutters are placed; likewise an upright groove or bar to receive the edge of the first shutter where occasion requires. *Patent completed.*

2541. S. Flexen. *Improvements in apparatus for ventilating railway and other carriages.* Dated September 16, 1862.

This apparatus consists in a combination of lines, pulleys, rods, weights, and eyes so fixed in relation to each other that, by moving the windows or lights, shutters, blinds, or otherwise, they then open or close the ventilator simultaneously, or regulate either to any required height or space, as described. *Patent completed.*

2542. W. Clark. *Improvements in the treatment of peat and peat tar for the production or manufacture of various products, and in apparatus for the same.* (A communication.) Dated September 16, 1862.

This consists in obtaining subproducts, ordinarily produced from coal tar, from peat tar, which is also termed azoted tar, or, in other words, the manufacture or transformation of the said tar into the subproducts below enumerated—viz., benzine, for cleaning purposes, or that used for the manufacture of nitro-benzine; petroleum and naphtha, for lighting purposes; phenic acid and its azoted derivatives; creosote; methylated alcohol; and various other products. *Patent completed.*

2543. R. Moreland, jun. *Improvements in machinery for preparing and cutting hops.* Dated September 16, 1862.

This consists essentially in the use of two rotating frames, one revolving within the other, each frame being provided with bars so arranged as to act as cutters. *Patent completed.*

2544. R. Lakin. *Improvements in the mode of plating or shielding ships of war.* Dated September 16, 1862.

This consists—1, in applying springs between the plates or shields and the sides of the ship, to act as an elastic cushion to the plates; 2, in supporting the plates, or brackets, or the like attached to the sides of ships, instead of bolting the plates to the sides; 3, in applying to the sides of ships metal pipes or tubes, or metal bars made wholly or partially of a circular or other curvilinear form. *Patent abandoned.*

2545. H. Jordan. *Improvements in rotary engines.* Dated September 16, 1862.

This consists in placing within the steam cylinder employed another cylinder or enlargement of the shaft, which latter is of less diameter than the steam cylinder. Two sliding pistons are arranged to work independently of each other in connection with this inner cylinder, and the ports are so arranged that one of the pistons may for a time be pressed in by the full pressure of steam from the boiler, whilst the other piston is being acted on by steam expansively. *Patent abandoned.*

2546. C. E. Guye. *Improvements in apparatus for cutting and finishing the teeth of watch wheels.* Dated September 16, 1862.

We cannot here give space to the details of this invention. *Patent abandoned.*

2547. L. Leigh. *Improvements in certain machinery for stretching and glossing silk, wool, and other fibrous materials.* Dated September 17, 1862.

This relates to a previous patent of the year 1860 (No. 1613), and consists in giving a revolving motion to the hanks during the process of stretching and glossing. Where the hanks do not require steaming, the patentee substitutes for the steaming-box a suitable frame, with hooks and other apparatus for holding and, when necessary, revolving the hanks while being stretched. *Patent completed.*

2548. S. Le Keeler. *Improvements tn veneer-cutting machinery.* (A communication.) Dated September 17, 1862.

This consists in suspending the table or currier to which the log is attached by screw bolts from two points, which enter and turn freely in the table, and which are inserted in discs or arms attached to the ends of rotary shafts. A rotary motion in opposite directions to each other is imparted to the shafts by a pinion secured to an arbour, which gears into two large cog wheels attached to the shafts, whereby the table receives a compound motion around the centres of the shafts, and in a direction parallel to a line drawn through the said centres. By this motion the cog is brought in contact with the knife at every revolution of the arms or discs, and that by a rotary drawing motion or stroke, whereby the perfection of the cutting operation is secured. The knife is secured to the frame that forms the bearings for the shafts, and arranged with a self-acting feed moving it the thickness of the veneer to be cut towards the log at the moment the log is at its highest elevation. *Patent abandoned.*

2549. R. Cranston. *An improved washing machine, to be called "The Waverley Hotel Washing Machine."* Dated September 17, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2550. J. Simpson. *An improved composition for coating or covering moulded or other surfaces, and in apparatus for applying the same thereto.* Dated September 17, 1862.

This composition is formed of an amalgamation of whiting, china clay, and glue, in such proportions as to form a semi-fluid mixture about the consistency of cream, or slightly thicker. The apparatus for applying this composition consists of a series of templates or gauges screwed together at the ends in a vertical position in a box form, the top being open for the reception of the composition. *Patent completed.*

2551. W. E. Newton. *Improvements in watches or time-keepers.* (A communication.) Dated September 17, 1862.

This relates to keyless watches, and more particularly to that part of the gearing whereby the hands are moved over the face of the watch. The object of this invention is to remedy various well known defects by the interposition of an intermediate wheel mounted upon a rocking frame, which is brought into action when the hands are required to be set. *Patent completed.*

2552. W. and W. H. Watson. *An improved process or processes for the preparation of certain colouring matters from aniline.* Dated September 17, 1862.

Here the inventors mix aniline with aqua regia in the proportion of about two parts of aniline and one part of aqua regia, and subject the mixture to a temperature of about 340 deg. Fahr., and by continuing this temperature colouring matter is gradually formed. The colouring matters produced are red, and blue, and another substance of a dark colour. They wash out the red colouring matter by water, and then treat the residue with alcohol, which dissolves the blue colour and the dark substance. To the alcoholic solution they add five or six times the volume of benzole, and leave the mixture at rest for some time to settle. The benzole retains in solution the black colouring matter, and the blue is precipitated. They then decant off the liquids. This blue colouring matter is soluble in alcohol, and is then ready for use. *Patent completed.*

2553. J. Douglas. *Improvements in apparatus applicable to close fire ranges, usually termed kitcheners, for the purposes of ventilation.* Dated September 17, 1862.

Here the patentee places the register or plate about two feet above the breast of the chimney, so as to form an inclined space of the expanded mouth of the chimney, which is, however, open below, and extends over the area of the range. From this plate he continues a tube up the chimney, which carries off the effluvia from the cooking, and ventilates the kitchen. A communication into the ventilating tube is also made near the ceiling. Rooms above the kitchen may be ventilated by lengthening the tube and providing suitable communications. *Patent completed.*

2554. G. Haseltine. *Improvements in apparatus for the manufacture of gas from petroleum oil and water, or from cannel coals, bituminous coals, schists, tar, crude coal oil, or other hydro-carbons and water.* (A communication.) Dated September 17, 1862.

This relates chiefly to the construction of a compound retort, to be used vertically or horizontally, containing three chambers, so as to admit of the introduction of water in its spheroidal state into the chamber at the bottom of the retort at a very high temperature, simultaneously with intensely hydro-carbon gases and vapours for the formation of permanent illuminating gases, and the prevention of subsequent condensation of volatile hydro-carbons, or the decomposition of carbon in the different parts of the apparatus. *Patent abandoned.*

2555. J. H. Johnson. *Improvements in gas burners.* (A communication.) Dated September 17, 1862.

This consists in rendering a gas burner self-acting, by so disposing a spring valve as to shut off the gas when closed, and allow of a free passage of the gas through the burner when opened. The opening and closing of this valve is effected by a bar composed of two metals soldered together and having different rates of expansion and contraction. *Patent completed.*

2556. L. Mond. *Improvements in obtaining hypo-nitric acid and nitric acid from nitrate of soda.* Dated September 18, 1862.

Here the nitrate of soda is to be made with a substance of basic or of indifferent character, which is neither melted nor changed by treating it with the nitrate of soda to redness. The following substances are some of those preferred:—The peroxide and the magnetic oxide of iron, the sesqui-proto-oxide of manganese, which is always obtained by heating any other oxide of manganese to redness, the oxide of copper, the sesqui-proto-oxide of cobalt, and the proto-oxide of nickel. This mixture of the nitrate of soda with one of the above-named substances is then to be heated in common retorts to redness. By this process a gaseous mixture is obtained composed of hypo-nitric acid, oxygen, and nitrogen, which can be immediately used for the manufacture of sulphuric acid. To obtain nitric acid from this mixture of gases, it must be conducted over cold water contained in suitable vessels. The residue in the retorts may be advantageously employed for the manufacture of caustic soda. *Patent abandoned.*

2557. P. H. Whitehead. *An improved support or stand for casks, barrels, or other similar vessels.* Dated September 18, 1862.

This improved cask-stand is supported upon a horizontal shaft, having bearings in two side standards, and the frame is brought to a vertical position to receive the barrel by turning a handle in connection with bevel gearing, and a worm and worm quadrant on the horizontal shaft, and by reversing the handle the cask is brought to a horizontal position, and may be tilted by the same means. *Patent completed.*

2558. R. Kay. *Certain improvements in printing calico and other surfaces, and in apparatus connected therewith.* Dated September 18, 1862.

This relates to the sieve used by block printers to supply the colouring matter, and consists in adapting such apparatus to cylinder printing particularly. The improved sieve consists of an internal cylinder, having an extended covering of india rubber, so as to form a chamber between the two, which chamber is to be supplied by tubes with water or liquid from a cistern, and the pressure duly regulated by valves; the surface of the india rubber may either be corrugated or covered with woollen or other fabric. The invention consists also in the use of an endless band of wire gauze as a substitute for the band of felt for supplying the colouring roller with colour by transferring it from the furnishing roller rotating in the colour trough to the said colour roller. *Patent abandoned.*

2559. W. and J. Todd. *Improvements in machinery or apparatus for "collecting waste or fly" from spinning machinery, whether for cotton or any other fibrous material.* Dated September 18, 1862.

This consists in the use of a series of rollers caused to revolve by traversing over the places where the waste or fly accumulates, so that in their progress they shall collect all waste or fly and retain it upon their surfaces until stripped. *Patent completed.*

2560. W. H. Browne and H. Armstrong. *Improvements in dry and wet gas meters.* Dated September 18, 1862.

This invention was described and illustrated at page 233, No. 222 of this journal. *Patent completed.*

2561. G. S. Moore. *Improvements in shipbuilding.* Dated September 18, 1862.

Here the inventor prevents the copper fastening from coming in contact either with the angle iron or with the bilge water (in ships built with an iron frame and wood planking) by surrounding its upper end with another metal which has not the same prejudicial action on the iron. He also makes the ends of two planks where they meet to lap the one over the other for a distance somewhat exceeding the space between the ribs, and he scurfs the ends together. The joints each fall correctly over two of the ribs, and the ends of each plank are fastened to each of the ribs, by preference, with fastenings as before described. *Patent abandoned.*

2562. J. W. Woodford. *Improvements in machinery and apparatus used for driving and drawing piles, also for raising soil, and also in shoes and hoops for piles.* Dated September 18, 1862.

We cannot here devote space to the voluminous details of this invention. *Patent completed.*

2563. T. Watts. *Improvements in combined thrashing machines.* Dated September 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2564. G. Loury. *Certain improvements in machinery for preparing, cleaning, cutting, and shortening the lengths of tow and other fibrous materials.* Dated September 19, 1862.

Provisional protection has not been granted for this invention.

2565. W. Glass. *Improvements in the treatment of sulphuret of antimony, and in obtaining products therefrom.* Dated September 19, 1862.

This invention consists in heating to redness in a close vessel, such as a crucible, retort, or flattened dish, sulphuret of antimony (antimony ore or crude antimony), with or without additional sulphur or antimony, and projecting upon or into them or it in a melted or fluid state, by means of a fan or pump, or by other means, either from the top or from any other direction, atmospheric air or oxygen gas, or both, provision being made in the crucible or other vessel for the ingress of air, oxygen, or both, and for the egress of vaporized products of combustion, oxides and sulphoxides of antimony and sulphurous acid, which are conducted into tubes, flues, or chambers where the oxides of antimony are deposited in fine powder, and the sulphurous acid gas may be collected or used as such: or it may be converted by oxygen and steam (aqueous vapour) into sulphuric acid, as is usually practised in vitriol works, or otherwise treated, while a portion of impure metallic antimony remains in the vessel after the operation has been continued some time, and may be purified for metallic antimony of commerce, or refined for gold, silver, or other metals. *Patent completed.*

2566. E. de la Bastida. *An improved cover for chimneys, adapted to prevent them from smoking, and to facilitate the extinguishing of fires therein.* (A communication.) Dated September 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2567. W. Tytherleigh. *An improved heater for ironing or pressing.* Dated September 19, 1862.

This invention consists of a hollow heater made of wrought or cast iron, which may also be made of brass, or of any material capable of standing heat. In the interior is fixed a burner, with holes therein to admit of one or more jets of gas, and to which is attached a tube, either elastic or otherwise, which may, if necessary, be jointed, and have a stop-cock for regulating the supply of gas to the burner. When necessary, the inventor uses with such heater a moveable board or platform for the heater to work on. *Patent abandoned.*

2568. J. and W. Smith. *An improved combination of machinery or apparatus for doubling, measuring, and plaiting woven fabrics.* Dated September 19, 1862.

The fabric is, according to this invention, doubled by passing it between the prongs of a fork, and over a rod carrying a roller, which revolves against the middle of the fabric as it moves onwards. The fabric then passes in contact with a measuring roller, and is drawn and led by other rollers to a vibrating frame, through which it is passed in order to plait it. The shaft of the measuring roller gives motion by toothed and worm gearing to an index plate, so that the quantity of fabric passed through the machine may be measured with exactness. *Patent abandoned.*

2569. J. Bouvet. *An improved mode of closing or sealing tin preserve boxes.* Dated September 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2570. D. C. Bridge and J. Dyson. *Improvements in the formation of boilers to be employed for warming buildings and similar purposes.* Dated September 19, 1862.

This invention consists in a new arrangement of water spaces and tubes, whereby a much larger amount of surface is exposed to the action of the heat than heretofore, and in some of the forms of boilers the smoke is also consumed, thus effecting economy in fuel. *Patent completed.*

2571. J. B. Giertz. *Improvements in gas burners or jets.* Dated September 19, 1862.

This invention relates more particularly to gas burners or jets known in the trade as "bat-wing" and "fish-tail" burners, and consists in adapting thereto a cap or cover of metal of the following construction; that is to say, the patentee forms a cap or cover of a dome shape, with a thin flat piece of metal across the centre thereof, and projecting from the outside thereof about three-eighths of an inch, leaving a slit or long opening across the cap close to each side of the aforesaid flat piece of metal, for the escape of gas from the ordinary gas burner or jet, over which the cap is placed and fits tightly round, leaving a space between and around the inside of the cap and the outside of the gas burner or jet for the gas to enter and pass through to form the flame of the burner. The effect of this arrangement is to obtain a large surface of flame with a small quantity of gas, and thus to effect a considerable saving in the consumption of gas. *Patent completed.*

2572. F. Savage. *Improvements in traction engines.* Dated September 19, 1862.

In carrying traction engines it is desirable that the driving wheels should be capable of being separately thrown in and out of gear with the crank shaft of the steam engine, so that the machine may be able to turn readily. The clutches now commonly used for this purpose are so formed that they cannot be thrown out without shutting off the steam and stopping the engine. According to this invention, the inventor forms, in the following manner, the clutches through which the driving wheels are actuated:—He makes the teeth of the clutch which engage the one with the other inclined at their sides in place of straight, as is usual, so that the incline of the teeth may give the clutch a slight tendency to come out of gear. He also makes the teeth of the clutch much more numerous than is usual for an ordinary traction engine. He commonly employs about sixteen teeth, whereas the ordinary clutch has but two or three. He finds that it is best not to form the teeth of the two clutch-plates exactly in the same manner, but that the teeth on one of the plates should be (although inclined) flat both at their sides and ends, whilst the teeth of the other plate are curved or convex on their sides. From this construction it results that, although the clutch-plates have but a very slight tendency to separate when they are held in close contact, as soon as the plates are slightly separated this tendency is increased. This construction also allows the clutch to be readily thrown in when the engine is running. *Patent abandoned.*

2573. W. M. Cochrane. *Improvements in securing the bolts and nuts of railway fish-plates.* Dated September 19, 1862.

The bolts and nuts by which the fishing-plate of railway rails are fixed are found constantly to shake loose in consequence of the vibration caused by passing trains, and men are now constantly employed to screw up these nuts. Now, according to this invention, the inventor, by preference, makes the bolt holes in the fish-plates circular, and at the outer side of the fish-plate he makes a notch or notches in the side of each hole. Between the fish-plate and the nut, and between the fish-plate and the head of the bolt, he places a washer or thin plate of such a size as to extend beyond the nut or head. This washer or thin plate has, by preference, a projection or projections on its inner side, which enter the notch or notches formed at the edge of the bolt-hole in the fish-plate; or he otherwise arranges these parts so that the washer, when pressed against the fish-plate, shall not be at liberty to turn on the bolt. The nut of the bolt is then screwed home, the washer or thin plate applied under the head of the bolt, and under the nut is bent at its edge, so that the bent parts may come respectively against the sides of the head and nut, by which both the head and the nut will be prevented turning. *Patent abandoned.*

2574. J. Imray. *Improvements in apparatus for telegraphing and signalling by means of electricity.* (A communication.) Dated September 19, 1862.

These improvements apply, in the first place, to apparatus for actuating the distance signals of railways, and for securing their correct action by means of electricity. For this purpose, on the column of the distance signal the patentee mounts a vane, disc, arm, or coloured light, which, when it is turned in one direction, shall indicate that the line is clear, and when turned partly round into another position, shall indicate that the line is stopped, or that it is unsafe for a train to proceed further. The inventor arranges in the column suitable clockwork of ordinary construction to act by a spring or weight, and he keeps the same constantly wound up and ready to turn the vane or light when a detent is withdrawn. This detent is acted on by electro-magnetic apparatus, connected by conducting wires with the station or place from which the signal is to be worked, so that an operator, by moving a suitable handle, when he desires to stop a train, introduces a battery into the circuit, which actuates the electro-magnetic apparatus, and causes the detent to be withdrawn. In combination with this arrangement, there are placed at the station, or elsewhere, bells, also connected with electro-magnetic apparatus and the conducting wires, so that when the battery is put in connection with the signal current, the bells commence to ring, and continue to do so until the distance signal has moved to its new position, when they cease to sound, in consequence of the electric current being cut off from the magneto-electric apparatus of the bells by the change of position of the vane of the distance signal breaking with the wire that communicates with the bell apparatus. He also arranges miniature vanes at the station or place where the operator is situated, which, by the action that stops the ringing of the bells, are caused to turn to a position corresponding to that of the distance signal they represent, so as to show that it has obeyed. *Patent completed.*

2575. R. R. Jackson and J. Coupe. *Improvements in looms for weaving.* Dated September 19, 1862.

The objects of this invention are—to save power, to diminish the friction and strain upon the warp, and enable the loom to be worked advantageously at a higher velocity, and all these objects are gained by shortening conjointly the "sweep" or radius of the crank and the length of the slay sword, or radius in which the slay oscillates, so as to reduce the oscillation of the slay to considerably less extent than at present in use. *Patent completed.*

2576. C. Chinnock. *Improvements in the construction of corkscrews.* Dated September 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2577. G. Maw. *Improvements in the manufacture of tesseræ and other mosaic inlays.* Dated September 19, 1862.

This invention consists in producing tesseræ and other forms employed in mosaic work of glass, enamel, or other vitreous material, by casting or moulding such forms upon a principle in which the finished article is discharged from a different part of the die or mould to that by which the molten material is admitted. *Patent completed.*

2578. E. Feis. *Improvements in the construction of locks, catches, or fastenings for purses, bags, or other receptacles.* (A communication.) Dated September 19, 1862.

For these purposes one of the sides of the frame of a purse, portmonnaie, bag, or other similar receptacle, is furnished with a fixed projection suitably formed for being suitably held or retained by a spring catch fixed on the opposite side or frame of the receptacle, which also carries the sliding piece, having a knob or projection passing through a slot in the frame to the outside of the receptacle. By imparting movement to this knob or projection on the outside of the bag or receptacle, an incline or receptacle on the sliding piece acts on the spring catch, so as to release the fixed projection on the opposite side, and thus allow the parts to open or separate. *Patent abandoned.*

2579. P. L. Forestier. *Improvements in photographic albums.* Dated September 20, 1862.

The patentee claims the manufacture of photographic albums in which the cartes or portrait are surrounded by a bevel-edged border, having the appearance of a frame, in any suitable manner. *Patent completed.*

2580. H. R. Fanshawe. *Improvements in the mode and means used in fishing in seas, rivers, and other waters.* Dated September 20, 1862.

This invention consists in the employment of a submerged or subaqueous light for the purpose of alluring or decoying fish, and thereby facilitating their capture. The light employed is derived from electricity, or from the ignition of oil or gas; or the patentee may employ phosphorized oil, or other luminous fluid, or any means for producing or maintaining a light under or below the surface of the water. Or he may obtain a sufficient volume of light for the purpose by reflecting light from above upon submerged reflectors. *Patent completed.*

2581. B. Hotchkiss. *Atmospheric trip hammers.* Dated September 20, 1862.

The object of this invention is chiefly to regulate the blow of the hammer and give elasticity to the parts, so as to give an elastic blow with the hammer, and at the same time prevent the breakage of the parts, which is one of the chief difficulties in the operation of trip and steam hammers. This hammer is provided with an air cylinder in which a piston is permitted to move and act upon air contained in the piston, in such a manner as to cushion the effect of the blow, and give it a portion of elasticity. The piston rod in this machine extends down from the piston in the air cylinder, and is connected below to the hammer. We cannot give space to the details of the invention. *Patent completed.*

2582. L. Dixey and G. Smith. *Tinting by lithographic printing photographic portraits and backgrounds, and embossing the same.* Dated September 20, 1862.

This invention is carried out as follows:—Having procured a good negative photograph in the usual manner, the patentees carefully block out the background with opaque colour or paper, in such manner that the background shall not print, but remain on the printed photograph white. After having procured a print off the negatives with a white background after the manner described, they fix, tone, and wash in the usual way with careful printing, and thus obtain a photograph ready for the following tinting, embossing, and colouring. They first lay the photograph upon a flat board, and upon that a piece af tracing paper large enough to cover the photograph; then with a lead pencil they trace carefully the outline of the photograph, which done, they remove the tracing paper, and cut out the line of the photograph which they wish to preserve from the tint about to be applied; they fix this upon the photograph by a little gum, carefully registering the outline of the photograph, for where this tracing paper does not cover there will be the tinting which was intended only for the background, and not for the portrait or landscape photograph. This being done, the tint of the desired colour is rolled on the lithographic stone and printed all over the photograph in the usual way of lithographic printing; the tracing paper which was fixed to the photograph, having prevented the ink from touching the print, may now be removed with a damp sponge. They then have a photograph with an evenly tinted back ground, and should they desire to give the print a tint all over of any lighter colour, they print again with the lithographic press all over the picture unprotected by the tracing paper, and which in some instances improves the general line of the photograph. 2, The photograph may now be embossed to give it the appearances and advantages of drawing paper. *Patent completed.*

2583. J. Wilson. *Composition for preventing and removing incrustation in boilers.* Dated September 20, 1862.

This invention consists in the employment of chemical precipitants for the lime and solvents for the silica, together with the materials which prevent the precipitate formed from caking and adhering to the bottom and sides of the boiler or tubes. The patentee employs a mixture of ground malt and woody fibres and other ligneous matters, also ground together with a caustic or a carbonated alkali and oxalate of ammonia. The latter two precipitate the lime and silica, while the malt and ligneous matters, aided by the constant ebullition in the boiler, prevent the precipitate from settling and incrusting. *Patent completed.*

2584. A. Prince. *Improvements in steam boiler and other furnaces, and in apparatus for feeding the same.* (A communication. Dated September 20, 1862.

This invention consists in certain improvements in the construction of furnaces, and in apparatus for supplying them with fuel, the object being that at every part of the surface of the grate the thickness of the layer of coal shall be regulated in an inverse ratio to the quantity of air required for its combustion, according to its condition of incandescence, and of its freshly-supplied coal or coke. The invention cannot be described without reference to the drawings. *Patent completed.*

2585. C. Mertens. *Improvements in machinery or apparatus for scutching and dressing flax, hemp, &c.* Dated September 22, 1862.

According to one part of this invention, the flax, hemp, or other fibrous materials to be scutched, cleaned, or dressed, are placed in hinged spring holders, which hold the fibrous materials firmly about midway of their length. These spring holders are placed on a table side by side, the ends of each holder being furnished with a sliding bolt and catch, and when the two parts of the holder are folded together with the fibrous material between them, the two ends of the holder are pressed together by a lever attached to the table, so as to allow the sliding bolt to be moved into a catch to connect the parts, and thus nip and hold the fibres firmly between them. Holders containing the fibrous materials may be passed by means of an endless chain or other mechanical means in continuous succession through the scutching machine, by being introduced between suitable guides at one end thereof, and as they pass out of the guides at the other end with part of the length of fibres scutched or cleaned, they are taken successively to the table before mentioned, and the cleaned ends of the fibres are laid over an open holder, which is then closed thereon, and secured as above described, the unclean ends being released from the first holder. The holder is then passed through the machine, as before described, so as to present the unclean ends to the action of the beaters, thus causing the fibres to be cleaned or scutched from end to end. *Patent completed.*

2586. J. Saunderson. *Improvements in writing desks and cases.* Dated September 22, 1862.

This invention relates to those desks known as "tourists," and "students'," and other like portable desks and cases, and consists in constructing such desks with two uprights to form the sides of the desk. The inventor places between these uprights compartments for holding paper, envelopes, and instruments, and he provides one or more drawers at the lower part or bottom of the compartments. He provides a pocket flap or not, as may be required, at the back of the case, and the folding flap - which is now formed of a single solid piece—he makes double and hollow to contain papers, letters, and the like. He also forms spaces in the back of the flap for containing ink and light holders. When closed the folding flap fits against the compartments and between the uprights, and a flap is brought over the top and secured in a lock or catch on the outside of the folding flap. *Patent abandoned.*

2587. H. Holdsworth. *Improvements in the manufacture of crinoline steel.* Dated September 22, 1862.

Provisional protection has not been granted for this invention.

2588. J. Long. *An improved machine for cleansing and scraping streets, roads, or ways.* Dated September 22, 1862.

This invention consists in adapting certain improved mechanical arrangements within a rectangular-shaped vessel, mounted on sliding wheels, so placed and adjusted as to allow one end to be near to the surface of the road, street, or way to be cleansed or scraped, and the other end to be connected temporarily to an ordinary cart to receive the dirt raised by the machinery, the said machinery being arranged and actuated as follows:—Within the aforesaid rectangular-shaped vessel, and crosswise thereof near its ends, two square shafts are mounted, so as to revolve. Over these shafts endless chains (formed of links each of the length of the side of the square shaft aforesaid) are passed, and have affixed thereto at certain distances from each other scoops of sheet metal. The hindermost of the aforesaid square shafts has a pair of running wheels fixed thereon, which, as they roll on the surface of the road, street, or way, impart rotary motion to the endless chains and scoops. The dirt is collected by spring scrapers mounted loosely side by side on a spindle fixed to the hindermost end of the rectangular receiving vessel aforesaid, the said end being made curved to allow the scoops aforesaid to remove therefrom the dirt which enters the same, and carry it forward and deposit the same in the cart before stated designed to receive the dirt. Beneath the bottom of the receiving vessel aforesaid, a false bottom is fitted and connected by levers at each side to the curved end of the said receiving vessel, the said curved end being moveable upon the axis of the running wheels aforesaid by means of curved toothed racks and sectors worked by the hand, for the purpose of keeping the scrapers aforesaid always in proper contact with the surface of the road, street, or way, as the sliding wheels of the receiving vessel are simultaneously moved either forward or backward, to alter the elevation of the front end of the receiving vessel aforesaid, either for connecting same to the receiving cart, or disconnecting same therefrom. *Patent completed.*

2589. W. McI. Cranston. *Improvements in machinery for reaping and mowing corn and other crops.* Dated September 22, 1832.

For these purposes, in order that a crop, as it is cut by a machine, may be raked back or off the table or platform of the machine, endless chains or bands are applied, to carry a rake or rakes. In carrying out the invention, it is preferred to use two endless chains or bands to a reaping or mowing machine, one on each side of the table or platform on to which the crop as it is cut is received. The ends of the rake or rakes are attached to the two endless bands or chains, to which continuous motion is given from the working parts of the machine. In order that the cutter bar of a reaping or mowing machine may be stopped and started under more favourable circumstances, the inventor applies a spring or springs, by preference of vulcanized india rubber, and stops in such manner that the cutter bar may be partially arrested by such stops and springs before it comes to the end of its stroke. *Patent abandoned.*

2590. M. Vogl. *Improvements in fastenings for leggings and other articles of wearing apparel.* Dated September 22, 1862.

According to the first arrangement, the patentee constructs a fastening, of which one portion or member is a pin, stud, or piece, having a head, outer end, limb, or part broader than, or projecting from its stem, shank, or body; this pin, stud, or piece is capable of turning wholly or partially round. The other member or portion of the fastening is a slot or opening, preferably edged or protected by a metal eyelet or rim. To effect the fastening, the pin or turning piece is introduced into the slot or opening, and turned sufficiently to bring its head, outer end, or projecting limb at an angle to the length of the opening or over its edge or side, in which position the members of the fastening are engaged. To disengage them, the pin or turning piece is turned so as to bring its end, head, or limb in such position with regard to the slot or opening that it can be slipped through the same. Or, in a second arrangement, he uses, instead of the pin, stud, or turning piece, a spring or springs of such shape and arrangement that, when compressed, it or they may be passed through the slot or opening; but when released or allowed to extend or return to its or their previous form, the arms or sides of the spring will project or extend over the sides or edges of the slot or opening, and effect the fastening. The spring may, if desired, be capable of turning wholly or partially round. *Patent completed.*

2591. J. and D. Mapple. *Improvements in telegraphic apparatus.* Dated September 23, 1862.

This invention consists of a flat endless chain rotated by a train of clockwork, and in its rotation it is made to rub against an inking roller supplied with printing ink, and so forming a tracer. A strip of paper is likewise carried forward by the said clockwork, and the strip of paper is made to rub continuously against the tracer, and the contact of the tracer with the paper is broken; or the paper is pushed away from the tracer as may be desired to give the signals by the attractive force of an electro-magnet, which magnet pulls an arm down and presses the paper away from the tracer, in contradistinction to W. Spence's patent communicated to him by Digney Frères (No. 279) of 1858, in which the arm moved by the electro-magnet presses the strip of paper against the tracer. The inventors purpose reading the telegrams by the white spaces instead of the inked lines of other tracing instruments, as by this arrangement the instrument is capable of being worked with a smaller amount of power than any other tracing instrument. *Patent abandoned.*

2592. R. Fairbairn. *Improvements in machines for combing wool or other fibrous substances.* Dated September 23, 1862.

This invention relates—1, to the transfer comb, carrying comb, or porter comb motion; and the improvements consist in the application thereto of a friction box or pair of flanges or collars with a washer of leather, india rubber, cloth, or other flexible material, placed betwixt to produce friction, the amount or degree of which is adjusted or regulated by a spring. By this means the inventor prevents that trembling of the comb which is now experienced when it is brought up to the "nip," or into contact with the nipping apparatus. 2, This invention relates to the nipping motion, and consists in the application of slide bosses and adjusting screws for attaching the cross bar on which the upper or top jaw moves, by which means the said top jaw can readily be set, adjusted, or regulated to the groove of the lower jaw, so as to obtain perfect parallelism thereof. *Patent abandoned.*

2593. T. and W. Knowles, and J. and W. Houghton. *Improvements in looms for weaving.* Dated September 23, 1862.

This invention relates,—1, to the box motion or to a means or method of working the rising boxes in looms for weaving, and consists in combining and arranging mechanism or apparatus for that purpose as follows:—At each end of the loom a tappet is fixed on the low shaft which operates upon the side-plates or brackets, capable of sliding in fixings attached to the loom framing. These slide plates support lifting horns or arms, which are capable of being operated by rods and levers from peg-lays or jacquard apparatus, and caused to take into one or other of a series of notches attached to or formed on levers which are hinged to the framing, and connected by rods to the rising boxes, which are thereby operated and brought into position, according as they are indicated and actuated by the peg-lays or jacquard apparatus. 2, This invention relates to the picking motion, and consists in combining and arranging apparatus for that purpose as follows:—An eccentric is fixed on the crank shaft (at each end of the loom) operating a slide bar or rod, on which is hinged a pair of horns or arms, capable of being operated by peg-lays or jacquard apparatus, and thereby brought into contact with one or other of two nibs or projections formed on a lever plate hinged to the framing, and according to the action upon which the picking lever is moved into or out of contact with the picking noses or picking tappets. 3, This invention relates to a lagging-back motion or means of turning back when the weft breaks or becomes used up. *Patent completed.*

2594. C. Pontifex. *Improvements in means or apparatus for removing or expressing beer from yeast or from hops.* Dated September 23, 1862.

For the purpose of carrying out these improvements the inventor takes a box, back, or other receptacle of suitable shape, which he mounts by preference upon four wheels; these wheels are made with the outer circumference hollow, which hollow is used as hereafter described. At a proper distance from the bottom of the box or back he places a shelf of wood of sufficient strength, which shelf is constructed with ribs on its surface to allow the escape of liquids when in use. A second shelf (or any other number of shelves may be used) is arranged to fit inside this box or back, and is provided likewise with grooves or ribs on its upper and under surface, and it is arranged to slide freely through the box. An upper or top shelf also is made, but arranged to pass to a certain distance down into the box or back, and then rest on the side of the box. To extract the beer from yeast or hops he takes a bag or bags made of canvas of the description ordinarily used for fining wine or beer, and of a length sufficient to fill up the length of the box or back before alluded to. He fills this bag with the yeast taken from "stillions," or from the "working tuns," and fastens the neck thereof when sufficiently full in any convenient manner. This bag is laid horizontally on the bottom shelf of the box or back, the middle shelf is then put in its place, a second bag similarly filled is then placed on the middle shelf, and the top shelf is then placed in position, and the beer is pressed out by weight or pressure applied to the top shelf. *Patent abandoned.*

2595. W. Dobson. *A new method of producing various colours on lace or other fabrics.* Dated September 23, 1862.

This invention has for its object the production of various colours on lace or other fabrics, whether made of silk, cotton, or other material. Hitherto it has been usual, when dressing lace fabrics (or other fabric), to dress each of them of one colour only, whereas this invention consists in the employment of various coloured dyes for one and the same piece of lace or other fabric, by which means the lace or other fabric acquires any required colours. *Patent completed.*

2596. J. J. N. Micas. *An improved railway break.* Dated September 23, 1862.

This invention consists in certain new and improved mechanical arrangements and combinations of parts so disposed and arranged as to be self-acting, and to operate in the running wheels of a railway train in such a manner as to interpose wedge-shape pieces of metal between the peripheries of the wheels and the surface of the rails on which the said wheels run, thus locking the wheels, and causing friction on the rails, so that the train slides or skids thereon. *Patent completed.*

2597. R. A. Brooman. *Improvements in lighting apparatus.* (A communication.) Dated September 23, 1862.

This invention consists of apparatus for reflecting, refracting, or amplifying light, composed of several prismatic curved or lenticular faces or mirrors, made to rotate round a fixed body of light sufficiently rapidly to cause the flashes of light to make a continuous impression upon the retina of the observer by sufficiently frequent periodical shocks, while the eclipses become unperceived by the observer. The rotary motion of this condenser of light may be continuous or intermittent, and may be produced by any mechanical force, such as clockwork. The light is stationary, and the luminous rays are, in whole or in part, condensed in a narrow zone; the lenses are prismatic or cylindrical to produce vertical bands of light. The light may be from oil or gas burners, or the electric or other artificial light may be used. There should be at least three faces or mirrors in the apparatus, but there should not be too many, about six is the most suitable number. Each of the faces receives a vertical luminous angle, which it transforms into a luminous band, also vertical. The apparatus does not increase the intensity of the light, but it amplifies the lighting through a lenticular refraction with entire destruction of dead angles—it projects the light to a distance. *Patent completed.*

2598. R. A. Brooman. *Improvements in photographic apparatus.* (A communication.) Dated September 23, 1862.

This apparatus enables the manipulator to operate in full light upon damp collodion, to sensitize the glass, and to finish the proof in the light. The apparatus does not alter the negative now used, but it serves as an auxiliary to it. In the apparatus the following characteristic elements are combined:—The employment of two vertical and independent bath vessels, arranged to allow of the glasses being easily plunged therein—one vessel containing the bath of silver for sensitizng the damp collodion, may be of gutta percha, hardened rubber, or other material having no action on the bath; the other, containing the iron bath for developing the picture, should be of yellow or orange-coloured glass; if made of any other material, it should be lined with yellow-coloured glass. There is a frame for holding the glasses to be exposed capable of being opened and closed at bottom by withdrawing or inserting a sliding bar. There is a second frame for holding the colodionized glass in the former frame, which second frame is styled the plunging frame, because it is used for introducing the glass into the bath vessels, entering also with it; it is insulated from the first frame and may be passed through it; a piece of catgut is attached to the plunging frame to raise and lower it into and out of the baths. *Patent completed.*

2599. S. H. Laurent. *An improved railway break.* Dated September 23, 1863.

This invention consists in the use of clamps which embrace and slide on the rails, power being exerted at a given moment to force them on the rails, and thus to oppose such resistance, almost in an instant, that the speed of a train is reduced to zero. *Patent abandoned.*

2600. W. Wilkinson. *Improvements in the manufacture of knitted elastic fabrics, and in the machinery employed therein.* Dated September 23, 1862.

Provisional protection has not been allowed for this invention.

2601. J. Farran. *Certain improvements in looms for weaving.* Dated September 24, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2602. W. Clark. *Improvements in signalling.* (A communication.) Dated September 24, 1862.

This invention relates to a universal system of signalling. The alphabetical transcription of words is replaced by the adoption of suitable signals, whereby the patentee effects the complete separation of words from their grammatical elements, such as prepositions, adverbs, or other parts of speech; the sign or signal for every word, such as a verb or substantive, and so on, is always the same, whatever may be the character of the word in the sentence, this character being indicated by a separate sign or signal, which points out the case, gender, number, tense, or the mood, and forms the verbs, adjectives, and adverbs, by being added to a substantive. The use of such grammatical signs or signals is reduced to a minimum. One single expression is substituted for several synonymous words, the simplest ideas alone being classed under signals; as for the complex ones, they are figured or represented by means of two or more signals themselves representing simple ideas. *Patent completed.*

2603. W. Taylor. *Improvements in blacking or polish.* Dated September 24, 1862.

In preparing this blacking or polish, the inventor takes slack coal (or its equivalent) reduced to fine powder (though he could, if desired, substitute or add ivory black, made by burning the bones contained in the pieces of flesh used by him), to which he adds indigo, and forms the same into a paste by mixing the following ingredients therewith, namely:—Fruits, such, for instance, as foreign fruits termed currants, raisins, dates, and the like, or any one of these reduced to a jelly; also animal jelly, such, for instance, as calves', cows', sheep or horses' feet, or any part of the flesh of animals that will reduce to a jelly; tallow, suet, or other fatty matter, and also acetic acid and lemon, the same being formed into a syrup by putting the lemons into the acid. *Patent abandoned.*

2604. R. A. Brooman. *An improved composition for painting.* (A communication). Dated September 24, 1862.

This composition, called "Neoline," is made by mixing two compounds, specially prepared and incorporated at the time of using. The first or liquid compound is composed of 750 parts of distilled water; 65 parts of oxalic acid; 60 parts of sugar, syrup, or other saccharine matter; 100 parts of alkali in salts or liquid (say, salts of tartar, soda, potash, ammonia, or other alkali, modifying the proportion according to the strength of the material used); and 25 parts of soft soap. The second or siccative compound is composed of 125 parts of white lead or zinc white, with barytes for its base or chalk; 125 parts of boiled drying oil; 250 parts of liquid siccative of any kind; 250 parts of zumatic (zumatique) white siccative in powder; 200 parts of soft soap (by preference mixed with silicate of potass or soda); and 50 parts of litharge. *Patent completed.*

2605. W. Maddick, jun. *An improved process or method of treating and preparing madder for dyeing purposes.* Dated September 24, 1862.

The patentee claims—1, treating madder for dyeing purposes after being ground by first saturating, damping, or wetting with water, and then allowing it to stand for anytime within 24 hours previous to or before it is placed in the dyeing bath or beck. 2, preparing madder for dyeing purposes by dyeing without pressure, or with limited pressure, after being treated as mentioned and claimed under the first head of the invention. *Patent completed.*

2606. D. and A. Posener. *Imporements in the manufacture of india-rubber and other tobacco pouches or purses.* Dated September 24, 1862.

In carrying out this invention the inventors propose to form the pocket of the pouch of the ordinary shape; but to ensure the safety of the contents, they add a flap to the mouth thereof, and instead of its being necessary for the cover of the pouch to be turned inside out, as is now the case, in order to enclose the pocket, they form the outer covering by cutting out a crescent-shaped or curved piece therefrom, in order that the pocket may be turned over, and its bottom part inserted or pushed under the curved opening, whereby it is easily retained. Thus, it is never necessary to turn the protecting cover inside out, the pocket of the pouch being merely folded over and inserted as just described. For tobacco pouches they propose to form a division in the centre of the pocket for the purpose of holding two different kinds of tobacco, the flap before mentioned covering both; or, to prevent the partial admixture of the tobaccos, the division may be continued into the form of a flap, or the flap or upper part of the division may be made in duplicate for the purpose of covering the mouths of both pockets. *Patent abandoned.*

2607. R. R. and A. I. Jackson. *Improvements in the preparation and treatment of flax and other fibrous materials to be subsequently operated upon by machinery employed for preparing and spinning cotton.* Dated September 24, 1862.

This invention has for its object the preparation and treatment of such fibrous material as is generally of longer staple than cotton fibre, so that such prepared fibrous material may be subsequently operated upon either alone or in combination with cotton or other fibrous material by such machinery as that commonly used for preparing, spinning, and weaving cotton alone; and the invention consists—1, in preparing flax, tow, or other fibrous material so as to be submitted to a carding process by any ordinary means, sometimes only to the extent necessary to put it to the tow card, and then carding the material, then operating upon the carded material by gill drawing combs to still further straighten the fibres if required; next, forming the material into a lap or sheet by means of a Derby doubler, or other suitable machine, and then cutting the laps or sheets into short lengths, by a machine similar to that described in the specification of a patent granted to the present patentees on the 24th day of September, 1862 (No. 2608), or any other suitable machine. When the fibrous material has undergone these processes, it is ready to be operated upon alone, or in combination with cotton, in ordinary preparing and spinning machinery for operating upon cotton fibre. *Patent completed.*

2608. R. R. and A. I. Jackson. *Improvements in machinery for cutting fibrous and other materials.* Dated Sept. 24, 1862.

This invention consists in certain modifications of machines which have been mostly used heretofore for cutting paper, such machine consisting of a knife which has either a vertical or a compound vertical and lateral movement, but the patentees prefer such as make a diagonal cut; the knives in these machines cut against or into lead or other soft metal or material. These improvements consist, namely, in combining a lattice or endless feeder with machines of the class above described to feed forward the material to be cut, which is made to pass between a pair of weighted rollers having intermittent motion imparted to them. *Patent completed.*

2609. W. Upfill and W. Asbury. *Improvements in the manufactnre of metallic bedsteads, part of which improvements are also applicable for ornamenting tubes and curtain and cornice poles.* Dated September 24, 1862.

This invention relates, in the first place, to that description of metallic bedstead in which the side and bars and rails are connected to the corner pieces by means of dovetailed joints, which have heretofore been made of cast-iron, and, consequently, have been exceedingly liable to breakage at at these parts, and when thus damaged the broken parts are useless. The first improvement consists in forming the dovetailed ends of the side and top and bottom angle iron rails or bars of wrought iron, instead of casting the dovetails on the ends of the angle iron rails as heretofore. The second part of the invention relates to a novel mode of ornamenting these tubes, posts, or pillars, and consists in covering them externally with perforated metal cut or punched out with any device. *Patent completed.*

2610. T. Edwards. *An improved mode of preparing fibrous materials for spinning.* Dated September 24, 1862.

In carrying out this invention, the inventor takes linen and cotton rags, and having carefully sorted them, he submits them to a series of operations, whereby they will be reduced to a state of separate filaments. The first operation to which he proposes to submit the rags after sorting them is, to a beating or tearing action in a machine constructed after the principle of the machine well-known in the cotton and woollen trade as the "devil." In this machine the woven threads will be torn asunder and brought to a state of loose filaments. These filaments he conducts to a carding engine for the purpose of carding out the same and reducing them to a state of fine fibres. The carding operation may be repeated until fibres of the requisite fineness are obtained, and he then converts the product into rovings, which will admit of being spun in the usual way of spinning cotton. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Nov. 28, 1862.

3194. W. Buller and J. H. Mugford, Bovey Tracy, Devon. Improvements in spur supporting rings for fixing plates, dishes, and other like articles in glost ovens.

Dated Dec. 16, 1862.

3364. H. Jörns, Tessin, Grand Duchy of Mecklenburgh Schwerin, watchmaker. Improvements in clocks or timepieces.

Dated Feb. 4, 1863.

318. W. T. Weston, 4, Trafalgar-square, Charing-cross. An improved spring catch or fastening applicable to windows and other useful purposes.

Dated March 5, 1863.

628. W. Clark, 53, Chancery-lane, engineer. Improvements in firearms. (A communication).

Dated March 6, 1863.

641. H. R. Spicer, 3, Clement's-lane, Lombard-street. Improvements in protecting and preserving the bottoms and sides of ships and other submerged surfaces from oxidation or fouling by incrustation, the attachment of barnacles, the action of animalculæ, or from any other like causes of injury.

Dated March 17, 1863.

716. W. E. Newton, 66, Chancery-lane, civil engineer. An improved preparation for the cure of scab, foot-rot, and other diseases of sheep and cattle. (A communication.)

Dated March 21, 1863.

757. E. Hartley, mechanical engineer, J. Clegg, machinist, and T. and J. Mellodew, manufacturers, Oldham. Improvements in looms for weaving.

759. F. Applegate, Bradford-on-Avon, Wilts, woollen manufacturer. Apparatus for making certain indications in railway carriages.

Dated March 23, 1863.

762. H. Hancock, 208, High-street, Southwark. A new combined range for making gas, cooking by gas, and lighting, especially applicable for ships.

763. J. W. H. and E. J. Rothwell, Ramsbottom, Lancaster, cotton spinners. Improvements in heating the feed water of steam boilers.

765. T. G. Grant, Royal Clarence-yard, Gosport, Hants. Improvements in ovens, and apparatus for heating the same.

767. W. Clark, 53, Chancery-lane, engineer. Improvements in agricultural apparatus. (A communication).

Dated March 24, 1863.

769. J. Reilly, New Globe Chair and Cabinet Works, Barrack-street, Hulme, Manchester, and W. Martin, Manchester. Improvements in lubricating horizontal shafting and bearings of all descriptions.

771. S. Healey, Elizabeth-street, Hackney-road, engineer. Improvements in the manufacture of zinc, and in the apparatus employed therein.

773. A., J., and J. Topham, St. Pierre les Calais, France, lace manufacturers. Improvements in the manufacture of ornamental twist lace, and in machinery used therein.

775. A. J. Cooke, Crown-court, Bow-street. Improvements in portable "Hooka" pipes.

Dated March 25, 1863.

777. M. Phillipps, Dewsall, near Hereford, engineer. Improvements in the manufacture of iron or other metallic rod and wire, and in the machinery or apparatus employed in such manufacture.

779. J. H. Worrall, Bacup, Lancaster, surgeon. Certain improvements in the method of producing surfaces in imitation of woods, and in printing therefrom.

781. C. Monson, New Haven, Connecticut, U.S. An improved gravitation engine.

783. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the manufacture of zinc, and in the apparatus employed therein. (A communication.)

785. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the manufacture of cords, ropes, and cables, and in machinery employed therein; applicable also to spinning, winding, and twisting fibrous and filamentous substances. (A communication.)

Dated March 26, 1863.

790. M. L. Parnell, 283, Strand. Improvements in the construction of locks, and in the method of adjusting their spindles.

Dated March 27, 1863.

802. W. M. Morgan, Kidderminster, Worcester, manufacturer. Improvements in coating metals, and in machinery and apparatus employed in coating metals.

804. J. Taylor, jun., Parliament-street, Westminster. Improvements in the construction and arrangement of the rain water pipes of buildings.

Dated March 28, 1863.

808. B. W. Goode, St. Paul's-square, Birmingham, manufacturer. A new journal, axle, or bearing, particularly applicable to rolls.

810. R. Sims, Bedford Foundry, Leigh, Lancaster, agricultural implement maker and iron founder. Improvements in reaping and mowing machines, part of which improvements are applicable to horse works.

814. G. Thomas, 50, Chichester-villas, Kilburn-park, Middlesex, builder. Improvements in window shutters and window blinds.

Dated March 30, 1863.

816. J. Musgrave, Globe Works, Bolton, Lancaster, engineer. Improvements in the construction of steam boilers.

818. R. Mushet, Coleford, Gloucester, metallurgist. An improvement or improvements in moulds to be used for casting steel or homogeneous iron.

820. J. Carver, The Butcher-street Works, Nottingham, bobbin and carriage manufacturer. Improvements in the manufacture of carriages employed in machines for the making of lace or other fabrics.

Dated March 31, 1863.

824. E. T. Hughes, patent agent, 123, Chancery-lane. An improved composition for rendering cloth, paper, and similar articles transparent and waterproof. (A communication.)

826. A. B. D. Maurand, No. 15, Passage des Petites Ecuries, Paris, gentleman. A translucid cylindric apparatus for bringing the former weights and measures into those of the present decimal system most easily and precisely, and *vice versa*.

828. W. Forrest, cotton spinner, and H. Duckworth, machinist, Blackburn, Lancaster. Improvements in looms for weaving.

832. H. Hamer, Kender-street, Old Kent-road. Improvements in tanning, and in apparatus employed therein.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, April 14, 1863.

3194. W. Buller and J. H. Mugford. Spur supporting rings for fixing plates, dishes, and other like articles in glost ovens.

3212. H. L. Emery. Thrashing machines.

3219. J. Romer. Manufacture of bullion wire and metallic fine drawn wire.

3229. J. and J. Craven and J. Robinson. Looms for weaving.

3232. T. Cook. Envelope-folding machinery.

3239. B. Browne. Construction of knobs or handles of door locks, and in the mode of connecting same with the sliding bolts thereof for advancing and drawing back said bolts. (A communication.)

3243. C. F. Claus. Carboy hampers, and in the machinery or other means for manufacturing the same.

3256. J. Robinson. Construction of ships and vessels.

3260. T. G. Webb. Manufacture of articles of pressed glass.

3267. W. J. Smith. Manufacture of collars, cuffs, and wristbands.

3270. H. A. Bonneville. Manufacture of stockings and socks. (A communication.)

3271. R. Thorp. Coating or covering for steam boilers and other surfaces to prevent the radiation of heat.

3272. J. C. and M. Craig. Apparatus for the manufacture of clay.

3274. W. McNaught. Machinery for washing and drying textile fabrics and materials.

3281. W. Palliser. Screw bolts.

3287. G. A. Huddart. Buttons.

3293. J. A. and C. L. Kiesling. Means of renewing worn-out and partially work-out files and rasps.

3295. T. Wingate, jun. Dredging machinery.

3299. R. A. Brooman. Treating liquorice root. (A communication.)

3300. G. Jeffries. Breech-loading firearms.

3306. J. Lamb. Tissue paper.

3307. W. Inglis. Steam boilers.

3310. S. B. Whitfield. Dovetail joints.

3312. A. P. Price. Blue colours. (A communication.)

3322. R. Clark. Apparatus for boring, winding, and lifting for mining purposes.

3324. J. Imray. Apparatus for mixing and kneading.

3326. T. E. Vickers. Construction of ordnance.

3329. J. E. Roussel. Looms for weaving. (A communication.)

3339. C. Corbet. Rails for railways, and in the mode of forming the joints of the same.

3348. G. Buchanan. Crushing sugar canes.

3374. T. C. Barraclough. Spinning, twisting, and rolling tobacco. (A communication.)

3383. E. Lepainteur. Fabrication of a salt for dyeing textile materials.

3392. S. C. Lister. Preparing, combing, and spinning flax, silk, and other fibrous materials.

3393. A. V. Newton. Transmitting power. (A communication.)

3415. G. E. M. Gerard. Fabrication of threads from vulcanized india rubber.

3438. W. Henderson. Obtaining iron and steel from certain ores and residual products.

3473. H. A. Bonneville. Manufacture of saddles. (A communication.)

79. E. T. Hughes. Apparatus for printing or staining woven fabrics, warps, paper, and other articles. (A communication.)

118. J. S. Butler. Manufacture of bobbin net made on bobbin net or twist lace machines.

262. H. A. Bonneville. Construction of granaries. (A communication.)

306. T. L. Jacobs. Apparatus for cleaning casks.

716. W. E. Newton. Preparation for the cure of scab, foot-rot, and other diseases of sheep and cattle. (A communication.)

770. G. Davies. Wrappers or papers for needles, and in machinery or apparatus for sticking needles therein. (A communication.)

779. J. H. Worrall. Producing surfaces in imitation of woods, and in printing therefrom.

798. W. Blake. Labels for luggage and other articles.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed April 13, 1863.

2570. S. Chatwood.
2751. G. Harvey and A. Harvey, jun.
2752. A. F. Gallis.
2755. W. Loeder.
2766. J. Snider.
2769. M. Cartwright.
2770. R. A. Brooman.
2772. E. H. C. Monckton.
2773. O. J. and J. Showell.
2777. W. Wilson.
2779. J. Taylor.
2782. W. Pope.
2788. R. A. Brooman.
2797. E. Humphreys.
2798. H. Ransford.
2800. J. Robinson.
2802. E. Nelson.
2803. J. Summerton.
2804. H. Wickens.
2813. B. Lauth.
2815. J. Fuller.
2846. H. H. and J. F. Kromschroeder.
2863. A. J. F. Vigneulle-Brepson.
2885. J. H. Johnson.
2921. J. Unsworth.
2930. G. Piggott.
2937. W. R. Bowditch.
2959. W. E. Newton.
3111. J. B. Edmondson, J. Carson, and J. Blaylock.
3282. G. Lowry.
3443. E. Stevens.
8. J. Jones.
121. B. Burrows.
199. R. Penney.
301. T. Raworth.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

898. W. E. Newton.
887. H. Bridle.
923. J. Hill.
895. L. J. Repelin.
899. J. Rigby and W. N. Norman.
924. A. Bamlett.
1064. J. Bullough.
935. M. A. F. Mennons.
991. T. G. Dawes.
905. T. H. P. Dennis.
960. C. Vaughan, W. J. Vaughan, and R. Vaughan.
1107. M. Bonnor.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

846. W. H. Gauntlett.
902. W. Fuller.
915. H. Y. D. Scott.
895. H. F. Forbes.
1124. H. Tucker.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending April 11, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2412	1	6	2423	0	10	2435	0	4	2447	0	8	2459	2	0	2470	0	4
2413	0	10	2424	0	4	2436	0	8	2448	0	10	2460	1	0	2471	0	10
2414	0	4	2425	0	10	2437	0	4	2449	0	8	2461	0	4	2472	0	10
2415	0	4	2426	0	8	2439	0	4	2450	1	4	2462	0	10	2473	0	4
2416	0	8	2427	0	4	2440	0	8	2451	0	4	2463	0	8	2474	0	6
2417	0	10	2428	1	0	2441	0	8	2452	0	8	2464	0	4	2475	0	4
2418	1	6	2429	0	4	2442	0	8	2454	0	4	2465	0	8	2476	1	0
2419	0	4	2430	0	4	2443	1	2	2455	0	4	2466	0	4	2477	0	4
2420	0	4	2431	0	10	2444	0	6	2456	0	4	2467	0	8	2478	0	4
2421	0	8	2433	1	2	2445	0	8	2457	0	6	2468	1	0	2479	0	4
2422	0	4	2434	0	4	2446	0	4	2458	0	4	2469	0	10	2480	2	0

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.
Teak.............. load	£14	0	£15	0
Quebec, red pine	3	10	4	10
,, yellow pine .	3	0	4	0
St. John, N.B., yellow	5	0	5	10
Quebec oak, white ...	5	10	6	10
,, birch	3	0	3	10
,, elm	3	10	5	0
Dantzic oak	3	10	6	10
,, fir	2	10	3	10
Memel fir	3	0	3	5
Riga.....................	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzic, fm	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	19	10
St. John, white spruce	14	10	16	10
Yellow pine, per reduced C.				
Canada, 1st qual. ...	17	0	18	0
,, 2nd do......	11	0	12	0

	£	s.	£	s.
Archangel, yellow...	£13	0	£13	10
St. Petersburgh, yel.	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white.	9	0	9	10
Gefle, yellow	10	0	11	10
Soderhamn...........	9	10	10	10
Christiania, per C., 12ft by 3 by 9 in.				
Christiania, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
PUMICE STONE pr ton	5	10	9	8
OILS, &c.				
Seal, pale ...per tun	48	0	0	0
Sperm body	82	0	82	10
Cod........................	47	10	48	0
Whale, Sth Sea, pale	44	0	0	0
Olive, Gallipoli	58	0	59	0
Cocoanut, Cochin...	53	0	0	0
Palm, fine	37	0	38	0
Linseed.................	42	5	0	0
Rapeseed, Eng. pale	52	10	0	0
Cottonseed	31	0	44	0

METALS.

		£	s.	d.		£	s.	d.	p ct.
IRON:—									
Welsh Bars, in London	per ton	6	10	0	to	6	12	6	2½
Nail Rods	do	7	0	0		7	10	0	
Hoops.............................	do	8	7	0		8	10	0	
Sheets, single	do	9	5	0		9	10	0	
Staffordshire Bars..............	do	7	10	0		8	0	0	
Bars, in Wales..................	do	5	10	0		5	12	6	
Rails	do	5	10	0		5	15	0	nett
Foundry Pigs, at Glasg, No 1	do	2	11	0		2	17	6	
Swedish Bars	do	11	0	0		11	15	0	2½
STEEL:—									
Swedish Keg, hammered ...	do	15	10	0		0	0	0	
Swedish Faggot	do	17	0	0		0	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts...	do	96	0	0		0	0	0	3
Hammered Bottoms...........	do	106	0	0		0	0	0	
Flat Bottoms, not Hamrd....	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	8½	
Fine Foreign	per ton	94	10	0		95	0	0	
TIN:—									
English Block.....................	per cwt.	5	19	0		0	0	0	2½
do Bar.........................	do	6	0	0		0	0	0	
do Refined..................	do	6	4	0		0	0	0	
Banca..............................	do	6	8	6		0	0	0	nett
Straits.............................	do	6	4	0		6	5	0	
TIN PLATES:—									
Best Charcoal, I.C..............	per box	1	8	6		1	9	0	3
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	3	0		1	4	0	
LEAD:—									
Pig, English......................	per ton	20	15	0		23	0	0	2½
,, Spanish Soft	do	20	5	0		20	10	0	
Shot, Patent......................	do	23	10	0		24	0	0	
Sheet	do	21	10	0		21	15	0	
White..............................	do	26	10	0		0	0	0	
SPELTER:—									
On the spot	do	17	7	0		18	0	0	nett
ZINC:—									
English Sheet.....................	do	23	10	0		0	0	0	2½
QUICKSILVER.......................	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	42	0	0		0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
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THE MECHANICS' MAGAZINE.

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The *Illustrated London News* of November 8th, when describing Benson's Great Clock says: "The movement of this clock, next to that of Westminster, is the largest in the world, and in point of quality of material, and finish of workmanship, it is unequalled by any known." Benson's new show rooms contain clocks designed by the first artists of the day, and include clocks for the drawing-room, dining-room, bed-room, library, hall, staircase, bracket, carriage, church, turret, railways, warehouse, counting house, with musical, astronomical, and every description of clock from the plainest to the highest quality of which the art is at present capable. Church and turret clocks specially estimated for. Benson's Illustrated Pamphlet on Clocks and Watches (free by post for two stamps) contains a short history of clock and watch making, with descriptions and prices. It acts as a guide in the purchase of a clock or watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world to select a clock.—J. W. BENSON, received a Prize Medal and honourable mention.—33 and 34, Ludgate-hill, London. Established 1749.—[Advertisement.]

THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, APRIL 24, 1863.

DISTORTED INDICATOR DIAGRAMS.

In most scientific and practical arts there are certain instruments that indicate the right course to be pursued in overcoming any given obstacle, and upon the right usage of which more or less depends the success or the failure of the special practitioner. We run little risk of contradiction in asserting that what the stethoscope is to the physician, the boring-rod to the miner, the hydrometer to the distiller, the blowpipe to the chemist, the indicator is to the steam engineer. It is only by a proper employment of this inestimable instrument, that tolerably true deductions, as to the internal working of an engine, can be arrived at with any degree of certainty—that a correct diagnosis can be formed as to the real state of the iron patient. Such being the case, it is perhaps surprising that more attention has not been directed to certain influences that in some cases undoubtedly distort an indicator diagram. These disturbing actions may be greatly modified by the construction of the indicator itself; they may be decreased or diminished by a proper or improper construction of the instrument; but these influences will always exist to a greater or less extent, and some allowance should be made on their account, before the diagram be accepted as a perfectly true picture of the performance of the steam in the cylinder.

The steam-engine indicator is especially liable to several objections when used for determining forces acting with great velocity and suddenness. The inlet of the steam is generally throttled by the narrowed apperture of the cock, and the indicator piston in its sudden ascent has to meet the column of air above. In the ordinary instrument there is a long and tremulous spring, which, from its length and weakness, is somewhat liable to rub on one side in the casing. The working parts are also often made unnecessarily heavy. When steam of a high pressure is let on to the indicator piston, the spring gives way and is suddenly thrown up; this action is aided by the momentum of the other moving parts; the pencil continues to oscillate during the remainder of the stroke; and the natural result is a jumping, serrated, zig-zag diagram. The total power indicated by the diagram is, perhaps, not very far from exactitude, as the action and reaction are probably about equal; but the most important function of the indicator consists in its giving the true performance and progressive course of the steam in the cylinder, and it is evident that, under such circumstances, the lines of the diagram have not that accuracy that is demanded by the importance of the deductions the experimenter wishes to obtain.

There is no doubt that the larger the indicator the better, other things being equal. The friction of the piston and of the moving parts is less in proportion; the cock and pipe are larger, the steam is thus less liable to be throttled in its passage to the piston, &c., and the divisions on the scale and the diagram itself being of a larger size, there is less chance of error. Watt used very large indicators, with powerful springs and a short throw of piston. It is stated that Watt obtained the scale of pounds by actual trial of weights pressing down the spring; but these results were taken while the indicator was cold, and, therefore, in a very different state, and in a different relation of the parts by measure than when the instrument is doing its work. It is evident that a more correct way would be to apply the weights on the top side of the piston while the indicator is fixed on the cylinder of an engine; the instrument being then in the same state as when performing its proper functions, the spring is of the same size and of the same elasticity as when in use, the whole apparatus on at a similar temperature, and the piston is lubricated with the same quantity of oil.

The weights being, one after the other, applied to the top of the piston, the atmospheric line and the gradual descent of the piston are then recorded by the pencil of the instrument and the principal divisions are thus obtained for a complete subdivision, and a true scale is the result. We should be glad to know how the principal manufacturers of indicators graduate the instruments, upon the exact performance of which so much depends. Perhaps the most exact way would be to use a properly-graduated mercurial column. There would certainly be some difficulty with this plan with an indicator for very high pressure. Mr. Parkes, the civil engineer, found that the pressures for the scale of the indicator were more correctly obtained by comparing them with a mercurial column than by ascertaining them by means of weights—"The instrument being then heated, was then in precisely the same state as when it was in use." He also found that a certain amount of correction was frequently necessary, as both the spring and the amount of piston friction were affected by heat.

According to Professor Moseley, the scale of ordinary indicators should not always be in equal divisions, because the wire of the spring being wound spirally into a screw of small diameter, the spiral obliquity of the thread of such a screw becomes "more oblique to the direction of the bending force as the spring is stretched, and less oblique as the spring is compressed, and hence the scale of pounds per square inch, by which the curve should be measured for summing up the results, ought to be a scale of unequal divisions."

Having thus alluded to a few points in the construction of this important instrument, that appear to us as being sometimes neglected by the makers, we will mention one probable source of wrong results more under the control of the experimenter. As is well known, the part of the engine giving motion to the string of the indicator ought always to be as near the instrument as possible, as otherwise the string will slacken, and the barrel will thus be stationary for an interval, of course the result being a wrong diagram. As it is of such great importance that the string attached to the indicator barrel should neither be too slack nor be too tight and liable to stretch, it has sometimes occurred to us that it might be advisable to use a kind of string worked up with fine wire, similar to the tape measures that are sold for measuring lengths of 30 or 40 ft.

There is also sometimes a danger to the exactitude of the diagram from the steam getting condensed. The most convenient way of taking a double diagram is by fixing the indicator to a pipe leading from the top to the bottom of the cylinder. This pipe being fitted with stop cocks, the two diagrams can be taken almost simultaneously. The great objection, however, to this plan consists in the natural tendency of the steam to get condensed in this small pipe.

There are, however, disturbing influences in the diagram of an indicator that are more beyond the control of maker and user of this useful instrument, and which do not seem to have been, as yet, thoroughly investigated by the writers on, and experimenters with, the steam-engine indicator. We allude to the partial vacuum created by the motion of a fluid, and at right angles to its course. We believe that this phenomenon was first noticed by Mr. Richard Roberts, the well known engineer, while making some experiments with a blowing engine in Manchester, in the course of the year 1826. This action may be easily and familiarly illustrated by placing a sheet of paper on the inside of the hand, and blowing from the back of the hand through the spaces between the fingers. The paper, instead of being blown away, as might be expected, is kept up against the palm of the hand by the partial vacuum between the palm and the paper, caused by the rapid and diverging current of air. This would seem to point to the necessity of placing the indicator on the cylinder at such a place, that it may be as little as possible influenced by the motion of the steam out of the ports into the steam pipes. This deteriorating influence on an indicator diagram would be more likely to occur on the vacuum side of a condensing engine, from the great speed of the steam rushing into a vacuum, than on the steam side. It would not improbably affect to some extent the diagram of a high pressure engine working at a high speed. There is another inquiry, no less interesting, as to the exact effect on a diagram of the speed of the piston. There is, of course, always sufficient time for the steam to follow the piston at full pressure if the piston moves slow enough; but at a higher speed, there is an undoubted reduction in pressure of the steam as it expands behind the piston.

Again, when a pair of coupled engines exhaust into one blast pipe, there is probably a reciprocative intermittent action of the back pressure of the two exhausts on the exhausting sides of the pistons.

The exact value of the objections we have raised against the accuracy of this important instrument could only be ascertained by means of a series of carefully conducted experiments; that these objections are more or less tenable, will be evident on reflection.

H.

CAST STEEL STEAM BOILERS IN PRUSSIA.

"We may be assured that, so certain as the age of iron superseded that of bronze, will the age of steel reign triumphant over iron." Such were the closing and doubtlessly prophetic words of the remarkable lecture on steel, delivered by Mr. Bessemer, July 31st, 1861, to a meeting in Sheffield of the Institution of Mechanical Engineers. In that instructive paper Mr. Bessemer described, in terms worthy of the subject, his extraordinary discovery—a discovery, according to Mons. Michel Chevalier, of more value to the world than all the gold mines of California. Great discoveries and inventions generally run in parallel lines, and help each other in their onward march. Thus, the inventions and discoveries of John Wilkinson and Henry Cort in the manufacture of iron; the spinning machinery of Hargreaves, Arkwright, and Crompton; the steam engine of Watt—all took their rise at about the same time. Each of there inventions was more or less dependent on the others, and they all in concert furthered each other's progress. Now the main direction towards which steam engineering practice has been tending ever since the time of Watt, has been the employment of high pressures of steam. The great resulting economy of fuel, and the reduction of first cost of the whole apparatus, are not the only advantages to be obtained by the use of high pressures.

The weak side of the steam apparatus, considered as a whole, has undoubtedly been the boiler. Wrought iron, the material generally employed in these structures, is always, from the peculiar manufacturing processes employed in its production, of a more or less treacherous character. This is more especially the case when wrought iron in the form of rolled plates is used in boiler-making. When the "puddled ball" has been reduced under the blows of the hammer and the pressure of the rolls into its ultimate shape, its congeries of welds or joinings will be drawn out by the above processes in the direction of the length. The strength of the plate, therefore, will be little affected as regards longitudinal strains in the direction of the fibre. Not so, however, if the plate be subjected to an explosive or rending force from the interior, as in a boiler. To use the graphic words of Mr. Bessemer himself:—"The extremely high temperature requisite to maintain malleable iron in a state of fusion, has, from the earliest period of the history of iron up to almost the present day, rendered its purification in a fluid state practically and commercially impossible; hence arise all those imperfections to which bar iron is subject—every small piece of this material consisting of numerous granules partially separated from each other by scoria, and every large mass of it resulting only from the piling together of small bars, with the inevitable result of increasing the former imperfections; for no two pieces of iron can be brought to a welding heat without becoming perfectly coated with oxide, and when this coating is rendered fluid by welding sand, a fluid silicate of the oxide of iron is formed, covering the entire surface to be united. The heavy blows of the hammer, or the pressure of the rolls, may and does extrude the greater portion of this fluid extraneous matter, but it is never wholly removed from between the welded surfaces, and hence a portion of the cohesive force of the metal is lost at every such junction." Nothing of this takes place with cast steel manufactured by the modern process. Its almost perfect continuity, and the absence of all welds, evidently point it out as the true material for steam boilers. Any flawed wrought-iron plate built up in a boiler will very soon bend and buckle under the action of the fire. The temperature of the surface of a boiler plate in contact with the fire diminishes with the thickness; and the thinner steel plate is thereby enabled to better stand the fire, for the very reason that it is thin. Thus far, regarding only the strength of a steel boiler, there could be little doubt, that, tried merely by the hydraulic test, a boiler of steel would stand a much higher pressure than one of wrought iron. Natural fears, however, were at first entertained that steel plate might change its character under the influence of fire on one side and of water on the other. Only careful observations and experiments, extending over some years, could raise the not unnatural doubts respecting the behaviour of steel under the influence of fire and water. Another important inquiry requiring a solution, was whether the high-breaking strain of the steel was not obtained at the expense of the ductile properties of the metal. We are enabled to lay before our readers an interesting account of some experiments very lately made in Prussia with a steel boiler in order to ascertain, with some precision, the advantages claimed for the use of steel in the construction of steam generating apparatus.* The particular boiler experimented upon is of the common egg-end shape, without flues; it is 4 Prussian feet in diameter, and is 30 ft. long,† inclusive of the spherical ends. There is a steam dome on the boiler, 2 ft. in diameter and 2 ft. high, as also a man-hole, 15 in. in diameter and 10 in. high. The thickness of the plate is one quarter of an inch thick. There is another boiler built in, parallel to the first one; it is exactly similar in every respect, except that the material of which it is made is simply common iron plate, the thickness of which is 0·414 in. Prussian. Each of the boilers works up to a pressure of 65 lb. The cast-steel boiler, however, was successively tried, by means of the hydraulic test, up to pressures of 98 lb., 130 lb., and at last up to 195 lb., without changing its shape in the least degree, and without showing any leakages. The only exception to this, was that two of the rivets slightly "sweated" under the great pressure of thirteen atmospheres, or 195 lb. After both the boilers were fired in a similar way, day and night, for about six months and a half, and at a pressure of 3½ to 3¾ atmospheres, they were carefully examined, the steel boiler more especially, during the Whitsuntide holidays, while the works were standing. It was then seen that the cast-steel plates were quite unaffected, even at the places most under the influence of the fire. There appeared, on examination, a remarkably small amount of incrustation in the cast-steel boiler, as compared with the boiler of common plate. This was ascribed to the fact that the steel boiler generated 25 per cent. more steam than one of common plate. It had been previously noticed, while the boilers were working, that the relative quantities of water changed into steam, in the steel and iron boiler respectively, were as 5 to 4. The impression produced by the above examination was strengthened after the boiler had been in use for a year and a half. At this subsequent examination, made only very lately, the plates, rivets, and the steam-tight qualities of the cast-steel boiler were in a perfect state, and it did not appear that the least injury had been caused by the fire to the plates more immediately under its influence. The small production of incrustation was confirmed every time the boiler was cleaned; while the incrustation was ⅛ of an inch thick in all the other iron boilers of these works, it was scarcely noticeable in the boiler of cast steel.

During the recent examination, the quantities of feed water were carefully measured by means of Giffard's injector, and the average of twenty days' work, of twelve hours each, gave the quantity of water converted into steam by the cast-steel boiler as equal to 139·92 cubic feet, and by the ordinary iron plate boiler 112·44 cubic feet. The cast-steel boiler thus evaporates 11·66 cubic feet per hour, while the boiler of common plate only steams off 9.37 cubic feet of water per hour. The ratio of the two above numbers (124·44 to 100) is thus almost exactly equal to the ratio of 5 to 4 obtained in the first experiments. During the same time, the quantity of coal consumed was on an average—for the steel boiler, 2,706 lb.; and for the iron boiler, 2,772 lbs., for twelve hours; thus with 1 lb. of coal 3.28 lbs. of water were converted into steam in the steel boiler, and only 2.51 lb. of water in the iron boiler. The steam-generating capabilities of the two boilers were thus as 127.49 to 100. The steaming power of the steel boiler being thereby no less than 28 per cent. higher than that of the other. It must be remarked that the amount of water we have referred to one pound of coal does not represent the *absolute*, but rather the strictly *comparative* evaporating powers of the two boilers, because these boilers are not fired directly, but by means of the waste gases of some puddling furnaces close by. It is also stated that, in several other iron boilers, the worn-out iron plates over the fires were replaced by steel plates, and that these have lasted as long as one and two years, while the previous iron plates were often burnt out within six months.

It is to be regretted that similar experiments to those we have just commented upon, are not oftener undertaken in England. Such experiments, conducted with the requisite scientific precision, are public benefits. The columns of our journal are always open to properly authenticated results of this character. The importance of mild steel as a material for construction needs only to be brought home to our engine and machine manufacturers to ensure its universal adoption; in any case, the prophecy of Mr. Bessemer will not fail to be shortly realized to its fullest extent; and we shall within no lengthened period see steel-plated ships, armed with steel guns and steel shot; furnished with steel boilers generating steam for engines with steel-connecting rods, cranks, and propellers.

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[*] Extracted from the "Verhandlungen des Vereins zur Befoerderung des Gewerbfleisses in Preusser's," by Dinglern "Polytechnisches Journal."

[†] One Prussian foot is not quite three-hundredths *less* than a foot English measure.

INSTITUTION OF CIVIL ENGINEERS.

At a meeting of the Institution of Civil Engineers, on the 14th inst.—John R. M'Clean, Esq., vice-president, in the chair—the Paper read was "Description of the Line and Works of the Scinde Railway," by Mr. John Brunton, M.Inst.C.E.

The importance of the valley of the Indus, as the route for commercial as well as for military communication with the Punjaub and the north-west provinces of India, was pointed out by Sir Charles Napier, the Conqueror of Scinde, so far back as the year 1842; and its many natural advantages subsequently attracted the notice of other eminent men. When, therefore, railways were introduced into India, attention was soon drawn to the Indus valley route, having Kurrachee as its sea terminus; and a concession having been granted to Mr. W. P. Andrew, the Scinde Railway Company was formed in 1355. This Company embraced under its management not only the Scinde Railway proper, or the line from Kurrachee to Kotree on the Indus, 108 miles, but also the Punjaub line from Moultan to Lahore and Umritsir, 240 miles, and likewise a flotilla of steamboats for navigating the river from Kotree to Moultan, 570 miles. Within the last three months the Goverment had entrusted to the same Company the construction of a line from Umritsir to Delhi, 280 miles, where a junction would be effected with the nothern terminus of the East Indian Railway. The total length of these four sections was 1,198 miles, but the accounts of each section were kept perfectly distinct.

The construction of the first section of this line, from Kurrachee to Kotree, which had been graphically described as "the neck of the funnel" of the entire system, formed the subject of this communication. After alluding to the works in progress for increasing the depth of water over the bar at the mouth of the harbour of Kurrachee, which was not only the natural port of Scinde, but also of the Punjaub and of Central Asia, and for extending the quay and wharf accommodation, reference was made to statistical returns, showing the rapid increase which had taken place in the import and export trade of the port during the last quarter of a century. Hitherto all commercial communication with the upper distaicts had been carried on by native boats on the Indus, or by caffilahs of camels—no roads worthy of the name existing. This led to great expense, inconvenience, and irregularity. The works of the Scinde Railway were commenced on the 29th of April, 1858, their execution having been originally let to Messrs. James and Edwin Bray, contractors; but since June, 1859, the works had been executed departmentally, without the intervention of a large contractor, by the Company's engineers and inspectors, who had thus favourable opportunities for becoming acquainted with the capabilities of the various classes of natives, as well as for ascertaining the cost of each description of work.

This mode of carrying on the works was forced upon the Company, by the peculiar exigencies of the case; but the Author thought, that for the construction of large works in India, under Government guarantee, the employment of a substantial contractor was a preferable plan. To secure the economical execution of the works, a fair tariff of wages was published, and daily payments were guaranteed. This had the effect of collecting a considerable number of labourers. The province of Scinde contained but a sparse population, and the Scindee was naturally indolent and devoid of muscular power, though not deficient in talent. The natives of the neighbouring state of Cutch were a much superior race, and from thence came a large proportion of the skilled workmen, such as carpenters, masons, smiths, and other handicraftsmen. From the hill tribes of Beloochistan and Affghanistan a hardy race of labourers was obtained. To maintain discipline amongst this body of men, it was found advisable to organize a regular railway police force; and to facilitate the administration of justice, a special magistrate was appointed by the Government. Owing to these precautions very few outrages of a serious charater had occurred. As the line of railway lay at a distance from existing towns and villages, it became necessary to make such arrangements for the feeding, shelter, and health of the different employés as policy no less than humanity suggested. The natives worked in gangs under a self-elected muccadum, or ganger, who made all agreements for work, received the earnings for division, and was himself paid a small per centage by the men. When work was executed by day labour, it was found that its economical execution depended entirely upon the energy and honesty of the muccadum, or native overseer. These qualities were so rare, that piece work had to be resorted to, though it was with difficulty that this was established as a rule. The average prices paid for earth and rock work per cubic yard were—alluvial earth excavated from side trenches and placed in embankment, 4.09 pence; firmly set gravel, or soft shaly material, 4.9 pence; rock requiring bars, but not blasting, 1s. 9d.; and hard rock requiring blasting, the powder, drills, &c., being found by the Company, 2s. Gravel ballast cost 1s. and broken stone ballast 1s. 10d. per cubic yard. The average prices of the principal kinds of work, including the cost of the provisional staff of superintendents, but exclusive of that of the permanent engineering staff, were as follows:—

Earthwork in embankments......	0s.	11½d.	per cubic yard
„ in cuttings, a large portion rock of different degrees of hardness	1s.	6¾d.	„
„ in diversion of roads and streams	0s.	8½d.	„
Pitching slopes	2s.	0d.	per square yard
Masonry, concrete........................	4s.	6d.	per cubic yard
„ dry rubble	3s.	0d.	„
„ common rubble	12s.	0d.	„
„ coursed rubble, with rubble backing	15s.	0d.	„
„ coursed rubble............	20s.	0d.	„
„ block in course	31s.	6d.	„
„ ashlar	1s.	7½d.	per cubic foot
Ballast..........................	1s.	6d.	per cubic yard
Leading and laying permanent way	6s.	0d.	per lineal yard
Fence walling..........................	3s.	0d.	„

The province of Scinde being situated in what was termed the rainless zone, the rainfall was very small, the average quantity measured at Kurrachee during the five years ending 31st August, 1860, amounting only to 5·32 inches per annum. Except during the rainy season, the river beds were dry, but in them water could generally be obtained, by sinking to depths varying from 5 ft. to 30 ft. All the water, however, procured from these wells was more or less saline. In neighbourhood of Kurrachee, the principal features of the country were low hills varying from 150 ft. to 200 ft. in height, consisting of a coarse-grained arenaceous rock, of a dirty yellow colour, abounding with fossils. Most of these hills were capped with conglomerate, more or less disintegrated on the surface. The hills lying north of the Indus to the foot of the Hala range, of which they were spurs, exhibited the effect of great disturbance, and the drainage of the country passed through the fissures thus formed. One of the most remarkable of these was at Dharwat, where during the rains the water of the Bahrun rose at times 70 ft., rushing through the pass with overwhelming force. The Kheytriani hills were composed of pale arenaceous limestone, and those in the neighbourhood of the Rhodh river of calcined clays of various colours.

The distance between Kurrachee and Kotree traversed by the Scinde Railway was 108 miles 10 chains. Of this, 32 miles 50 chains were level, and 75 miles 40 chains were on inclines more or less favourable—1 in 200 being the ruling gradient. The total length of straight line was 74 miles 22 chains; the length of the line on curves was therefore 33 miles 68 chains, the sharpest curve having a radius of 43 chains for 76 chains. The earthworks were generally executed to accommodate a single line of railway, but all the bridges, culverts, and stone viaducts were constructed to carry two lines. In the case of wrought-iron viaducts, the stone piers were adapted to support girders for a double line, while those required for a single way only were erected. Between the workshops at Ghizree junction and the terminus at Bunder head, a distance of 3 miles 15 chains, the line was double; and a short branch, 3½ miles in length, had been constructed from the workshops to the eastern delta of the Indus. The permanent way consisted of the ordinary double-headed rail, fixed in chairs, laid on transverse wooden sleepers. A large proportion of the sleepers were of yellow pine creosoted, sent from England. It was intended to complete the required quantity with sleepers of deodar timber, from the Himalayas; but the native merchant having been unable to fulfil the contract, a supply was purchased of Australian blue and white gum, and native red eyne sleepers. Their respective costs were, creosoted yellow pine 8s. 11d., Australian blue gum 8s., and eyne 7s. 9d. each, delivered in Kurrachee; that of deodar delivered in Kotree being 6s. each. The deodar sleepers were at first steeped in a solution of sulphate of copper, to protect them from the attacks of the white ant, but a Burnetizing apparatus had since been erected at Kotree, where the cost of applying the process only amounted to fivepence halfpenny per sleeper. The result of the Author's experience was, that creosoted yellow pine sleepers split and twist to a great extent, owing to the extreme dryness of the climate, and that they become very brittle. The majority of the fencing consisted of a dry rubble-stone wall, having a coping of stones on edge, set in mortar. Locomotive erecting and repairing shops had been built where the Ghizree branch left the main line. The organization of these works, with a view to their ultimate utility, and at the same time having regard to economy, was surrounded with many difficulties. To employ entirely European workmen would have involved enormous cost. It therefore became necessary to call in the aid of native carpenters and smiths, as far as practicable. They first had to be induced to stand to their work, and then to be taught the use of European tools. This had been accomplished by degrees, and the result had been most satisfactory; the carriages now framed and erected at these shops by Cutch carpenters displaying admirable workmanship. To keep up a supply of European foremen, fitters, engine-erecters, and engine-drivers, the system of taking the sons of European soldiers and clerks as apprentices had been adopted, by which a staff of men thoroughly acclimatized was being educated in all branches of railway mechanism. The electric telegraph with two lines of wires, carried upon posts of deodar, let into cast-iron sockets, was laid along the railway. The block system of working the trains was employed; the needle-speaking instruments being used for conveying information between the station and passing places.

As the line crossed the natural drainage of a great extent of country, a large provision for waterway was necessary. It was comparatively easy to fix the spans of the bridges at the rivers and nullahs, but in crossing wide flat plains the question was difficult. The plain at Pipri was nearly 5 miles broad. Originally, a number of culverts was built there, and catchwater drains were cut, to conduct the rain into the river Guggur. In 1861 the rain was very heavy for six hours in this locality, and the water was ponded up by the embankment, which was soon breached in several places. The line was then lowered to the natural surface of the ground, being in fact laid in a ditch, 16 ft. wide and 2 ft. deep; and during the unusually heavy rains of 1862, the water flowed over the rails to the depth of 9 in., without either damaging the line, or stopping the traffic. Whenever the height of the embankments would admit of it, and to secure the largest amount of waterway, the culverts had a span of 8 ft. 6 in., the permanent way being caried in such cases upon teak timber beams, which supported a platform of planks, covered with ballast, as a protection from fire. The heaviest piece of masonry upon the line was the large stone viaduct across the the Bahrun river. It was 1728 ft. in length, and its greatest height was 31 ft. 6 in. The superficial measurement of the bridged area was 44,064 square feet. It consisted of thirty-two arches, each 46 ft. span, and having a rise of 10 ft. 6 in. Its total cost was £27,185. This viaduct was completed in twenty-two months and a half. There were six viaducts with iron girders, on Warren's principle, of 80 ft. span each, the total number of these spans being forty-two. From experience the author could not speak favourably of these girders, when contrasted with the plate girder, as there was an amount of vibration, both laterally and vertically, caused by passing trains, which had the effect of breaking or loosening the bolts and fixing the longitudinal timber stringers to the cross girders. The viaduct across the Chinnee creek would consist of ten openings, each of 100 ft., spanned by girders of plate iron, of elliptic form in elevation.

The extension of railway communications into wild and uncivilized countries demanded from all grades of the employés the exercise of more than ordinary observation, self-discipline, and energy. It would therefore be wise policy on the part of all foreign railway compaines, and the contractors for the works, to be more strict than they had hitherto been, in ascertaining that the agents sent out from this country at great cost, were something more than proficient in the practical details of there profession as they ought also to be possessed of gentlemanly feelings and habits, by which alone the respect of the uncivilized native could be obtained, and his services secured, so as to reduce the cost of the work, and convert the railway engineer into a pioneer of civilization and a missionary of science.

At the Monthly Ballot the following candidates were balloted for and duly elected:—Messrs. W. D. Dent, M.A., J. Fogerty, J. Lewis, G. W. Rendel, and T. C. Townsend, as Members; Messrs. H. W. F. Bolckow, H. Bolden, O. Bowen, C. W. R. Chapman, J. Davis, C. Gott, C. T. Hargrave, C. Löwinger, R. C. Rapier, and A. Rumball, as Associates.

INSTITUTION OF NAVAL ARCHITECTS.

Having in preceding numbers given abstracts of the principal Papers read before the Institution on the first day, we now proceed to give abstracts of some of the Papers read on the second day of the meeting. The first Paper read on the second day was "On Experiments at Sea with a Rotary Ship-Clinometer," by Professor C. Piazzi Smyth, Astronomer-Royal for Scotland. This instrument, the author said, is based on the principle of free rotation, of which the gyroscope is a well-known example, and is of a differential character only. It has, therefore, no power of determining absolute inclinations or angular position with reference to horizon or meridian, but gives only the successive differences of position which may occur during a limited period of observation. In so far it is inferior to plumb-bobs, levels, fluid surfaces, and all things depending on gravitation for their zero points, but it is superior to them in two points:—1. It is capable of measuring deviations of angular position in every plane, azimuthal as well as vertical; to which latter, gravitational instruments are confined.—2. It is entirely uninfluenced by any of those motions of translation which, either continuous or frequently reversed, are perpetually taking place in every ship at sea, and are of a nature to mix up with the simple clinometrical movements of all gravitional instruments and destroy their value for any exact reference. If, then, this instrument can be produced in a practical form, it can hardly fail to yield valuable and peculiar results when applied to the measurement of the rolling, pitching, and yawing of ships at sea—all of these movements being fully amenable to a difference measuring instrument, and to no other. The author described in detail the construction of the instrument, and then its adjustment and use, stating that, if the instrument be carefully balanced, it will not require further adjustment for a month. In using the instrument, he found that the real difficulty lies chiefly in the complex nature of the phenomena to be observed, viz.:—the angular motions of a ship at sea, which are nothing less than the motions of a pendulum suffering such a continual state of multifarious disturbance that it never makes two successive vibrations exactly alike, but often exceedingly different. The author then showed that, in a case which he tried on board the "Edinburgh," in the Baltic, on the 27th of July, 1859, the mean angular value of a roll was 2·7 deg, and the mean period five seconds; the number of rolls from which this mean was obtained being twenty-one, and the author found it most expedient to compress the results of his observation into these forms, viz.:—to give from the mean of twenty or more observations the average period in seconds of time and the amount in degrees of either a "roll," or a "pitch," or a "yaw" of the ship, as each of them might be observed one after the other, and thereby established the character of the sea, or the movements of the ship upon it for that particular time. On the occasion above-mentioned, when the period of a roll was found to be five seconds, and its amount 2·7 deg., the period of a "pitch" was found to be eight seconds, and the amount 0·6 deg., the motion of the ship being described as "gentle and pleasant" to the feelings. But the movements had been described as decidedly disagreeable on a previous occasion where a roll had a period of four seconds with an amount of 5·5 deg., and a "pitch" a period of three seconds only, with an amount of 2·7 deg. The latter was a case of crossing the North Sea, against an easterly ground swell, and with a N.E. wind on the beam; while in the former case they were going free before a west wind. This mode of registration, even in these simple average particulars, told a great deal. The author concluded by stating that there is much more in the movements of the sea than average particulars will always bring out, and gave tables showing that a series of individual observations sometimes brought to light the existence of extensive undulations of a long period; and showing also the sensibility of the rotary ship clinometer, and the very complicated nature of the phenomena which it is required to observe. The Paper contained tables of results of observations acquired on the voyage above mentioned.

The next Paper read was "On the Rolling of Ships as influenced by their Forms and by the Disposition of their Weights," by J. Scott Russell, Esq., F.R.S., Vice-President, I.N.A.

The author stated that Professor Woolley, at the opening of the Institution, had in an admirable Paper laid before them with judicial impartiality, the condition of the science of Naval Architecture, and had mentioned the strong points and the weak points of their knowledge, in order to direct their attention to the adoption of established truths, and their immediate application to their designs of ships, and also to diligent research in those regions of inquiry where exact principles were still wanting. Among the points which had been established as matters of science, but not commonly used in professional practice, he pointed out the whole of the questions affecting the stability of ships, their power to carry top-weight, and pressure of sail in smooth water, and in a state of rest; he mentioned the questions relating to motion of ships, of the resistance of ships when propelled through smooth water, and of the behaviour of ships in troubled water, as questions to a great degree unsolved. The author was sure that it must be gratifying to Professor Woolley to find that the impulse he gave had not been thrown away on members of the Institution, but had been responded to by three valuable Papers—one by Mr. Froude, one by Mr. Crossland, and one by Professor Rankine. The author then said he had taken to himself the investigation of the following narrow question:—What were the forms, proportions, and distribution of weights which a naval architect would adopt, in the present state of their knowledge of that question, as likely to give to a ship the best behaviour in a sea-way—taking into consideration the peculiar circumstances for which the ship might be designed? It was necessary, he said, at the outset of the inquiry, to ascertain what qualities in the behaviour of a ship they wanted to find; for if ease were to be the one thing, they had only to search in a certain direction, and he thought they knew where to find it. But there were quite other qualities they might have to search for; easy rolling was good, but limited rolling was in some instances much more important, as was especially the case in a man-of-war, where it was desirable to keep the gun platform as nearly level as possible. He proposed to seek out from the knowledge which had been contributed upon that subject, what recommendations they might safely adopt or reject. There were two problems to be solved of a very different nature, depending upon whether an easy movement be required, or a stable platform; but there were certain circumstances common to both in regard to which he would state certain definite conclusions. He then dwelt upon the uneasy, lifting motion occasioned by the injudicious form of the ship at the water-line, and which form was such that great difference existed between the immersed and emersed portions of the sides of the vessel when rolling; and he spoke also of the flare-out bow as being a form of bow having no advantages, but rather serving to give the ship an accumulation of vertical motion when pitching a and scending, and a series of violent concussions with the waves. The first condition, then, of course, would be that the body of the ship should be so formed that at the water-line there should be no flare-out above the water, or rapid falling away under the water; and that could be accomplished by making the surfaces of the ship between wind and water nearly vertical. He would go a little further, and adopt a tumble-home line as far as he could along the middle of the ship, and he approved of as much tumble-home at the bow, in a large vessel, as could be conveniently introduced. Having supposed all bad forms to be removed from a ship, so that all the parts near the surface of the water could rise out of it and go into it again quite easily, the next question was, what further should they wish to obtain in regard to the movement of a ship on the waves? Did they wish her to rise and fall, to roll and right herself in a lively manner with every undulation of the sea, never taking in the water, but, as it is called, swimming like a duck? That was a kind of movement desirable for some purposes, and he would call it the quality of rolling with the sea, and would carefully examine it. The rolling with the sea was to be obtained by great breadth, little draught of water, and extreme lightness with a large buoyant out-of-water body. He found it convenient in analysing the properties of a ship, to use the phrases "out-of-water body," "under-water body," and "shoulders;" by the under-water body, meaning the part which in rolling does not come out of the water; the shoulders, meaning those parts which are commonly called wedges of immersion and emersion, or the parts of a ship between wind and water; and the out-of-water body, meaning that which rises above the shoulders. He comprehended in the shoulders 14 deg. above and below the water, a size which laid a depth of side under the water equal to one-eighth of the beam of the ship, and which raised a like proportion out of the water. He next treated of the faults of such a vessel as the one above referred to: showing that it was not calculated for carrying heavy weights, or for holding on a wind, or for the general purposes of a ship; and that it was in fact a barge, fast to fly before the wind, and wholesome to go on shallow water or through breakers; but the great danger to a ship, all shoulder, and no under-water body, was that across a sharp and breaking sea she was liable to capsize; for, when the sea broke, the front and back of the wave became nearly perpendicular, the shallow vessel took, of course, the position of the surface of the water, and having taken it on the face of the wave, she would retain it on the back of the wave, so that what was the top before would become the place of the bottom now, or, in other words, she would be turned over. This, he said, was the extreme result of extreme liveliness; for all other cases, liveliness seemed safety. The rolling with the wave, he said, was accomplished in a high degree by a plank floating on the water. He next took a vessel of the *extreme other sort*; and that he would represent by a vertical plank floating upright, and kept in that position merely by having its centre of gravity slightly below its centre of buoyancy; it then remained to consider what were the movements to which in the course of wave motion it would have to submit. He observed that this question was a more complicated one, and stated that during every wave the water performed both a vertical and horizontal oscillation. Its greatest motion forward was at the top of the wave, its greatest motion backwards was at the bottom of the wave, its greatest motion upwards was at mid-height on the rising wave, and its greatest motion downwards was at mid-height on the descending wave. From this it was to be gathered that a floating body standing upright in the water was violently pushed forward during one-half of the motion, backwards during the other half, and upwards and downwards. Moreover, it was proved and admitted that those motions were performed circular-wise, and that each point in the water, and each point in the float, moved in a circular path, and its revolution was perfectly uniform. But the circular path of a body floating on the surface of the water was, unhappily, very different from the circular path of a body immersed below the surface; and after showing by diagrams the effects these conditions had upon the two planks, and explaining the causes of various phenomena presented, he stated that the practical use to be made of such conditions was, that if the naval architect made his ship all flotation at the surface, he must combine with it a deep vertical body; and it might be so proportioned that the forces acting on the one to produce oscillation one way might nearly balance the forces tending to produce oscillation the other way, and between the two the vessel would be saved from rolling. He then went on to say that great capacity and carrying power might be had in the midship portion of the vessel, without her following the surface water, if care were taken to give her a long, vertical line of bow, and a sharp, deep deadwood; and thus the evils arising from surface oscillation might be remedied by using the peculiarities of deep water oscillation. The author next considered how far the disposition of the weights in the interior of a ship affected her stability and rolling; and, first, he questioned the wisdom of lessening her stability under canvas for the purpose of giving her a longer periodic time of roll, and he did so after having carefully examined the subject, and compared the principle with a long course of practice. Having treated of two different kinds of stability—one being due to the form of the vessel, and the other being due to weights placed within her—he said that, to understand them apart from each other, the centre of gravity must be placed where it could have no action on stability, which was in the axis of motion, or in the centre of the water-line of such a ship as he was then going to describe. He supposed a ship to be inclined by any two forces; they had the part under water divided into two—a symmetrical body and an unsymmetrical body—the former part always under water, the latter placed under water or taken out of it as the ship inclined to either side; the one he would call the under-water body, the other he would call the shoulder. In reference to stability, one tended to upright the ship, the other tended to overset her; the resultant of these two forces determined the stability or instability of the ship. The momentum of that resultant force measured her power to resist overturning, whether from force of sail or any other force. The distance of that resultant from the axis of the ship was one measure of her stability; because, in that case, the height of the meta-centre above the water-line measured the stability of the ship arising from form and bulk merely, or, as he had said, it was the stability of form. He would next treat of that kind of stability which arose from weight; and for that purpose would, first, raise the centre of gravity above the axis of rotation, so as to get the action of the top weight. Such a condition counteracted the righting power of the shoulder, and tended to overturn the ship; and in proportion as he raised the weight, he counteracted the stability which arose from form, and when he had reached the height of the meta-centre he had entirely neutralized it. It was necessary, he said, to discriminate between these cases for the future; what was called a measure of stability, was more properly a measure of spare stability, or stability still to be disposed of. He would call the measure of stability of form, the absolute height of the meta-centre above the water-line; the height of the centre of weight above the water-line would be measured by the height of the centre of gravity above the same line; and the remaining height left between the centre of gravity and the meta-centre, would be the just measure of the surplus stability still to be disposed of. He then proceeded to show the errors which arose from confusing the terms; and that it was possible for vessels having the same interval of distance between the meta-centre and the centre of gaavity to have a totally different behaviour in a sea-way; and from his own investigations, he said, he should adopt very different maxims from those which Mr. Froude had arrived at. First, he should not deem it expedient to design a ship with a high meta-centric height out of water, and a high centre of gravity, for the purpose of diminishing the velocity of oscillation; second, he would not design a vessel with weights placed high, nor at a great distance from the axis of revolution, for that purpose; third, he would endeavour to diminish the extent and violence of rolling motion in the design of a new ship by diminishing the total meta-centric height above the axis of rotation, and by that means seek to diminish the forces by which the water acts to cause rolling; fourth, the absolute meta-centric height in a good form of ship might be greatly reduced —even to the level of the water at the load-water-line; fifth, the extent to which the place of the centre of weight of the ship and cargo migh be lowered easily, must depend mainly upon the purposes of the ship; but with a low place of meta-centre, and a lower place of centre of gravity, preserving between them only the interval required for carrying sail, all the injurious movements and stresses which injure and endanger a ship would be a minimum, and all the forces tending to produce oscillation being reduced to a minimum in total quantity, they would have the least need of strength and force.

The next Paper read was "On Isochronism of Oscillation in Floating Bodies," by W. Froude, Esq., Assoc.I.N.A. The following is an abstract of it;—

The equations of motion for a ship rolling in a sea-way, as given by Mr. Froude in his Paper, *Trans. I.N.A.*, 1861, were rigorously applicable only to a ship which would perform isochronous oscillations in still water, and objections had been expressed to this condition as impairing the practical value of the equation by too greatly limiting the range of its fair application. It was therefore worth while to inquire how far ships of any ordinary type were likely to deviate from isochronism, and what specialty of form isochronism implied. The answer would arise out of a comparison between the *vis viva* embodied in the oscillatory motions of ships of various forms, and the dynamic stability out of the discharge of which the *vis viva* was generated in the course of each oscillation. The statical moment of stability due to the inclination of a given stable floating body was well known to be wholly expressible in terms of two equal vertical resultant—sone, ship's weight acting downwards through the ship's centre of gravity; the other, her flotation acting upwards through the centre of buoyancy—their combined action forming a "couple" whose span is the horizontal interval between them. Thus no horizontal motion could be impressed on the ship's centre of gravity from the mere operation of these forces; nor could any such motion arise in the course of oscillation except for the secondary or deviation forces involved in the quasi-wave motion impressed on the volumes of water contiguous to the ship in the course of her oscillations. And as this exception could not be serious, and was probably trifling in amount, it remained that practically the whole movement of an oscillating ship might be expressed in terms of an angular motion *round* her centre of gravity, and the *vis viva* embodied in each of these motions would be as the square of its velocity. In the former, it would be the "moment of inertia" of the ship's mass measured on her "radius of gyration;" in the latter, it would depend on the form of the ship; but even in the most extravagant Symondite, its ratio to the "moment of inertia" would scarcely be greater than that of $M_2\theta^2$ to ρ^2, (M being the height of the meta-centre above the centre of gravity, θ the angle of inclination, and ρ the radius of gyration), and even with $\theta = 60$ deg. this could scarcely exceed 1-64th. Now since, *cæteris paribus*, the time occupied in performing work is as the square root of the amount of work, the addition of 1-64th to the work will only enlarge the time occupied in the performance by about 1-128th; so that practically, we may extend to large angles the proposition usually limited to small ones, that the work to be performed in the oscillation of a ship is measured by her moment of inertia round her centre of gravity. Hence, Chapman's view, that a ship suspended by her meta-centre would oscillate in the same period as if afloat, errs in the ratio of her radius of gyration when so suspended to her radius of gyration round her centre of gravity; practically, the former would seldom exceed the latter by more than 10 or 12 per cent. If, however, the point on which the meta-centre hangs, be itself free to take lateral motion (as when if it be the end of a long line suspended from a great height), the oscillation will be performed round the centre of gravity (which will undergo also a small vertical motion), the conditions will be almost identical with those of the ship as afloat, and the period of oscillation will be in each case the same. And if a similar mode of suspension be applied to the plane on which, in a well-known proposition, the ship is supposed to oscillate like a rocking-chair, the range of the proposition may be extended to any meta-centric involute, since all horizontal motions involved in the action may thus be eliminated. If the figure of the ship be such that her meta-centre when upright is also her meta-centre for all inclinations, she will have the same relation to an isochronous ship, which the ordinary pendulum bears to a cycloidal pendulum; and the enlargement of her periodic time up to an angle of 50 deg. or 60 deg., may be sufficiently expressed by a ratio involving a single term of the appropriate series, and which is equivalent to (1 ÷ 1-8th vers θ): at 60 deg. this would be only 1 + 1-16th. The form of ship which involves isochronism is that in which the moment of stability is as the angle of inclination; and the question as to what form involves this law, or any other particular law, can only be answered relatively. Given the form of the immersed body, what must be the corresponding form of the superstructure? If we express the form of the whole ship by an equivalent midship section, the primary type of the form which has an unchanging meta-centre is circular, but the same result is secured if throughout all inclinations the immergent and emergent surfaces form the same angle (the one tending inwards, the other outwards, or *vice versa*) with the line flotation; and this construction involves the condition that the breadth at the line of flotation (or what is equivalent, the moment of inertia of the plane of flotation) is the same for all angles. From a ship thus figured, an isochronous ship may be at once derived with a high degree of approximation, by lengthening in each case the equivalent line or breadth of flotation, in the cube root of the ratio of the arc to the sine of the inclination, since the growth of the moment of stability is as the cube of that line, so that we shall thus approximately work out *mutatis mutandis*, the analogy of the moments of the simple pendulum to those of the cycloidal or isochronous pendulum.

A Paper "On the Comparative Straining Action upon a Ship of different Kinds of Vertical Oscillation," by Professor W. J. Macquorn Rankine, C.E., LL.D., F.R.S., Assoc.I.N.A.:—

The author stated that he was induced to write this Paper by the publication of some remarks in the third volume of the "Transactions" of the Institution, by Mr. Froude, questioning the accuracy of the commonly received opinion, that the vertical oscillation of the centre of gravity, or "bodily rising and falling" of a ship of the form known as the "Symondite," constitutes an "uneasy motion;" that is, as the author understood it, a motion that produces peculiarly severe stress on the structure of the ship. For brevity's sake, he called that kind of oscillation the "dipping motion," because it consisted of an alternate dipping into and rising out of the water. Another kind of vertical oscillation, whose straining effect would compare with that of the "dipping motion," was the vertical component of the motion of the ship when she accompanied bodily the motion of the waves; and this kind of motion he, for brevity's sake, called the "heaving motion." The dipping motion of a "Symondite" ship, said the author, originates in the difference for a given angle of roll, between the "solids of immersion and emersion;" and the extent of that dipping motion, though not necessarily equal to, depends upon, the depth found by dividing that difference by the water-line area. That depth, indeed, is very nearly one-half of the extent of the dipping motion which would be produced by a very sudden roll. If we call the depth found by dividing the displacement by the water-line area the "mean depth of displacement," then half the extent of dip for a very sudden roll is less than the mean depth of displacement, very nearly in the same proportion that the difference between the solids of immersion and of emersion is less than the displacement. This rule he expressed algebraically, and then remarked that the extent of the dipping motion was in every case small as compared with the extent of the heaving motion. In a well-proportioned ship, he continued, the rolling motion is less frequent than the heaving motion, which keeps time with the waves; hence, if the periodic time of the dipping motion were the same with that of the rolling motion (that is, a dip and a rise to each double roll), there could be no doubt of the accuracy of Mr. Froude's conclusion—that the straining effect of the dipping motion is trifling. But the dipping motion has a periodic time of its own, which is always considerably shorter than the periodic time of the rolling motion, and which may be considerably shorter than that of the heaving motion also. It is quite possible, therefore, that the greater frequency of the dipping motion may make up for its less extent, so as to make its straining effect on the ship considerable. It is further to be remarked, said the author, that the possible extent of the dipping motion is not limited to the double of the depth stated previously. That depth is one half of the extent of the dipping motion, which may be set going by a *single sudden roll*, and which, even though the rolling should stop, will be followed by a series of dips of gradually diminishing extent until the motion is stopped by the resistance of the water. When a "Symondite" ship makes a series of rolls, each roll originates a fresh series of dipping oscillations; and should the periodic time of rolling happen to be double, quadruple, or any *even multiple* of the periodic time of dipping, so that each roll coincides with the rising part of the previously existing dipping motion, the extent of the dipping motion may go on continually increasing to an amount limited only by the resistance of the water; just as the extent of the rolling motion of a ship may, as Mr. Froude has shown, go on increasing when its periodic time coincides with that of the waves. The author then proceeded to explain how the several parts of a body are acted upon under different conditions, and showed that when a heavy body, supported in any manner, undergoes a simultaneous and equal variation of the motion of all its particles, as in bodily oscillations of a ship, the straining effect is the same as if the weight of each particle, and of the entire body, were changed into the resultant of that weight and of a force equal and opposite to the force required to produce the varied motion. He next dealt with the motion in question as an isochronous oscillation, and gave a rule, and expressed algebraically in what proportion the change in the resultant reaction of each particle, and of the entire body, is equivalent to an *alternate increase and diminution of the weight*. The *heaving motion* was next considered. Its periodic time, the author stated, is the same with that of a pendulum whose length is to the length of a wave as the radius of a circle to the circumference; and then followed various applications of algebraical formulæ, showing the proportionate stress and comparative straining effect of the two motions; from which it appeared that the straining action of the dipping motion was by no means trifling in comparison with that of the heaving motion produced even by a wave of considerable height; being less only in the ratio of 725 to 1,250, or 4 to 7 nearly. He concluded by saying that the results which he had shown were in accordance with his former statement—that it is possible that the frequency of the dipping motion may make up for the smallness of its extent, so as to make its straining effect considerable; and in conjunction with the possible increase in extent of the dipping motion before described, they confirm the prevalent opinion that the so-called "Symondite" form, which tends to produce dipping oscillation, is a cause of "uneasy" motion, and of undue strain upon the ship.

At the evening meeting, Friday, March 27, 1863—Henry Chatfield, Esq., Vice-President, I.N.A., in the chair—the first Paper read was by Mr. Charles Lamport, Assoc.I.N.A., "On the Construction and Support of Iron and other Masts and Spars." The following is a brief abstract:—

The strength and fitness of the masts and spars of a ship, for the service they had to perform, were elements in the success of the whole sailing machine, as important as the strength and durability of the hull itself. Broadly considered, the last twenty years had not effected any important changes in the masting and sparring of vessels, except such as had arisen from the necessity to supplement the natural deficiencies of the original material, wood; or from the substitution of another material altogether, iron. The introduction of iron and steel in place of wood, for the masts and spars of ships, had opened the whole question to reconsideration. In designing an iron mast, the first, and most obvious point, was to determine the nature and degree of the strain it had to bear, along with the exigencies of its form and application; the second was to arrange the material in quantity and shape so as most effectually to meet that strain; and the third was to modify the relation of the two to the extent that the exigencies of their application would allow to suit the capabilities of the new material. In reference to the first of these heads, the author showed that the normal strain which the mast has to bear is brought upon it as upon a column. Unsupported by the shrouds, no mast can uphold its own weight against the violent motions of a ship at sea. To design an iron mast, with a view to resist the maximum transverse strain brought on it, would be a waste of material. The object should be to answer the demands upon its strength as a column, consistent with lightness, absence of bulk, ease of maintenance and repair, and a provision for cutting away. To secure these, we must give up the idea of taper spars, and of tall masts, "bending like a fishing rod," and imitate rather the human spine, the vertebrate articulations of which, upheld by muscular supports, combine at once columnar strength with easy motion. The mast should not taper, because every particle should be brought as nearly as possible into the direct line of the strain applied; otherwise there will be a tendency to "buckling." The usual plan of wedging should be abandoned with iron masts, because it converts the mast into a beam, in the position least capable of resisting a transverse strain, viz., fixed at one end and loaded at the other. The lower mast, topmast, and top-gallant mast should each be rigid in itself, but yielding with an articulated flexure to the elastic spring of the shrouds and stays. The oscillation of each should be from the keel, and the author therefore applies a cast-iron foot, terminating in a ball a little flattened in the fore and aft direction to prevent the mast twisting and widening above to give a flat, even, but moveable support to the plates of the hollow mast. The flattened ball works in a cast-iron socket or step. The author explained that this construction agreed with the experiments of Hodgkinson, and after further reference to those experiments, and also to Dr. Fairbairn's, stated as the results of calculation, that iron masts, even of ½-inch plates, when uncrippled by wedging, were superior in strength to wooden masts of ordinary dimensions. He next gave an elaborate description of various practical details of construction in reference to masts, top-masts, and yards, recommending a great variety of improvements in those details, and next proceeded to consider the support of masts, &c. The efficient support of the mast of a ship was a question of equal importance with that of the mast's capability to maintain its portion of the duty of propulsion. Considering the masts as pillars, the measure of their support was the measure of their efficiency. The problem for solution was to apply a given amount of support most usefully, under the conditions of working efficiency. Every step in its solution necessitated a compromise. The masts had to be supported laterally, as well as fore and aft. It would be easy by "spreading" the rigging to give a more direct support against the forward pressure of the wind; but what was gained in this direction was lost in the power to withhold the mast against the side pressure. Again, the more complete the support, the more rigid became the system of masts and yards to the loss of a certain storage equalization of force absorbed and given out by their elastic play. That spring, and consequent momentum, should depend upon the elasticity of the shrouds entirely. If they adopt wire rigging they must sacrifice more or less of this advan-

DONKIN'S AXLE BEARINGS.

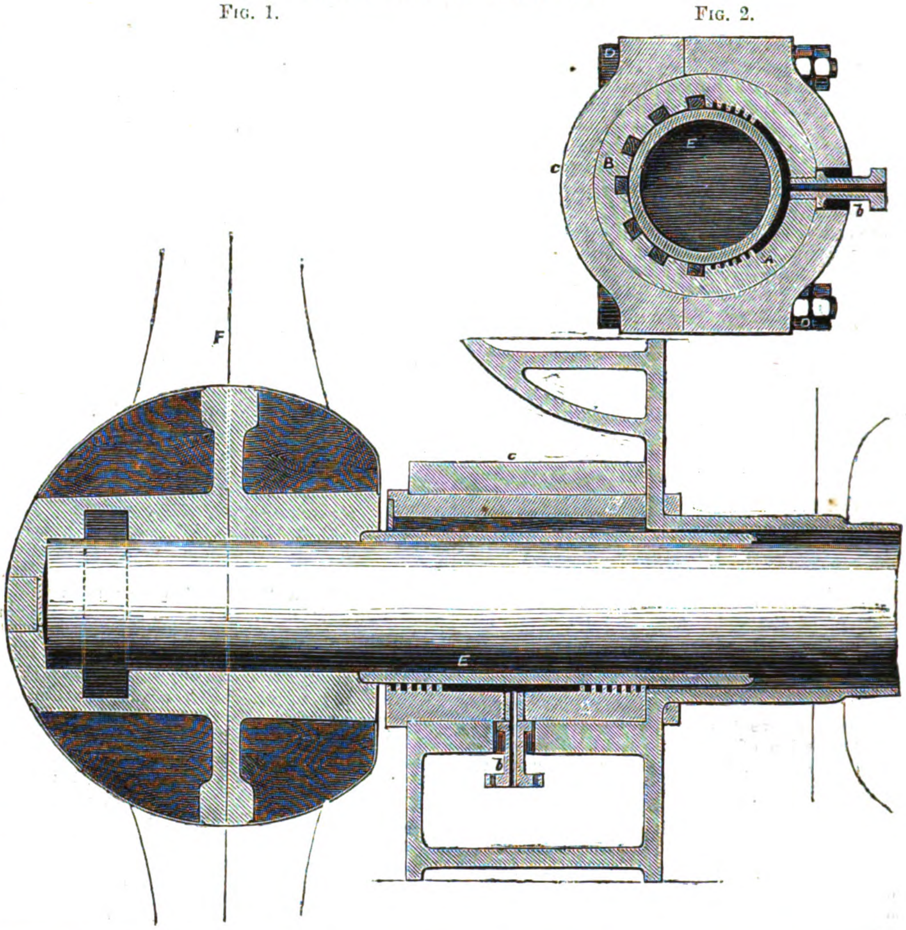


Fig. 1. Fig. 2.

tage. They made a compromise between the lightness and less resistance presented by it to the air, "on a wind," and the play and momentum of the whole system. He advocated the separate attachment of each pair of shrouds at points varying from the cap at the mast-head to the truss hoop of the lower yard. Further, he proposed to combine the advantages of both hemp and wire rigging by the use of the former for the two aftermost shrouds, and of the latter for those whose sustaining power came into play. In conclusion, he said that if proof be deemed indispensable for the anchors and chains of ships, why should the masts and spars be passed over without test? The one class of appliances was as indispensable to the safety of a ship as the other. He thought that a few preliminary experiments, instituted under proper superintendence, with a rule that all variations should be satisfactorily "proved," would very soon supply an amount of information on this subject which would be as interesting as it might prove beneficial to every branch of the shipping interest.

G. C. Mackrow, Esq., Assoc.I.N.A., then read a Paper "On a New Mode of Constructing Iron Bulkheads."

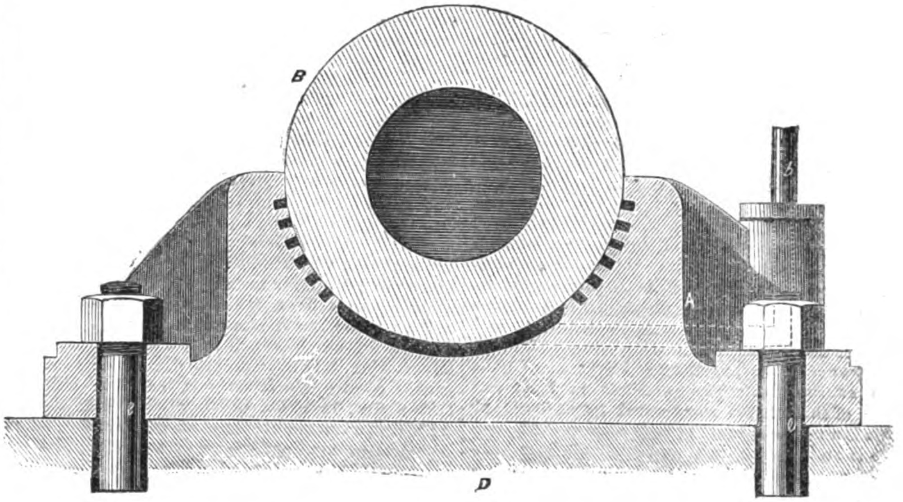
After alluding to the precious freights and living cargoes that vessels have often to carry, the author urged the great importance of water-tight compartments, and hence the desirability of obtaining the most complete and efficient vertical bulkheads with a given amount of material. Reference was made to a sketch showing a bulkhead constructed in the usual manner, with the exception of some slight additional thickness at the middle, and he then stated that, at the wreck of the "Tyne," in the English Channel, some few years back, several of the plates of the engine-room bulkhead had their rivet-heads sheared completely off, and great overlapping of the plates was the result. He next drew attention to a sketch showing his proposed method of construction, the two principal features of which are, 1st—the whole of the bulkhead is worked "flush" or "jump-jointed;" and 2nd, it is supported at the vertical and horizontal joints by T-irons which form at once butt and joint straps and stiffeners—an angle iron being placed between every alternate T-iron to further support and stiffen the structure. He considered the value of such bulkheads in vessels of war to be indisputable, since when a vessels strikes her adversary with her stem, the impact or force of the blow is transmitted to the middle-line bulkhead; and he spoke of the "Minotaur," "Northumberland," and "Agincourt," as having bulkheads in course of construction on a method similar to the one proposed, the chief objection to them, however, being that an increased weight of iron is employed. This the author illustrated by tables showing the quantity, description, and weight of iron necessary for the construction of two bulkheads of the same area, which tables served to show that a saving of about $2\frac{3}{4}$ per cent. would be effected by the adoption of his proposed method. The author next proposed another method of construction by which, too, considerable saving of weight would be effected, the chief point in it being to work the plates vertically instead of horizontally, placing a T-iron at every joint. But he confessed that this method did not in all respects accord with his own notions, so he left the matter to be dealt with by the eminent gentlemen present, who would doubtless point out any real practical objections to the adoption of the plan.

[Mr. W. J. Hay's Paper "On the Fouling of Ships," which followed that read by Mr. Mackrow, appeared in the last number of the Mechanics' Magazine.]

James Watt a Photographer.—A discovery of great historico-scientific interest is said to have been just made. It is alleged in a letter published in a Birmingham contemporary that "distinct evidence has been got to show that James Watt was engaged in photographic experiments, and that he took portraits." This announcement is certainly startling enough, but we are assured that "it is true."

DONKIN'S AXLE BEARINGS.

Fig. 3.



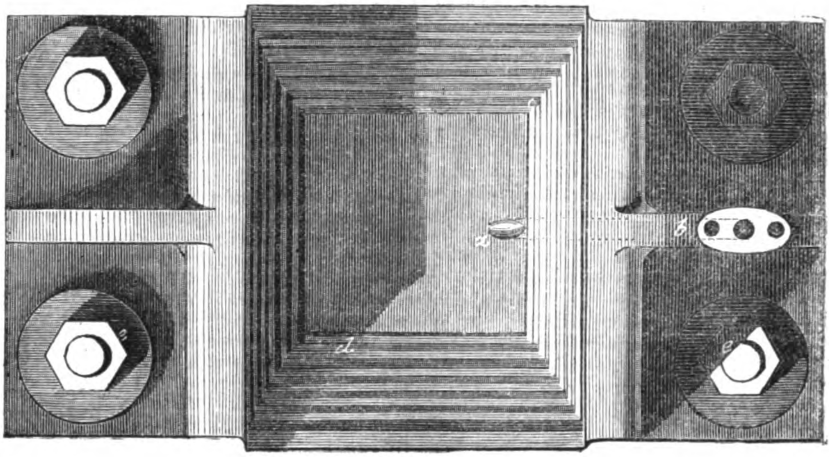


Fig. 4.

DONKIN'S AXLE BEARINGS.

Mr. Bryan Donkin, of Bermondsey, engineer, has recently patented an improvement in bearings for axles and sliding surfaces.

The invention consists in providing a water or liquid bearing for shafts, axles, pivots, and sliding surfaces, by a continuous circulation of liquid forced between a metal box and the shaft, axle, pivot, or sliding surface, so as to prevent contact of surface with surface, whatever be the material constituting such surface.

The box or case is shaped to correspond with the shape of the revolving or sliding surface to be used with it, and form therein a central cavity, followed by several concentric quadrangular or other cells, according to the surface. An orifice is made in the central cavity to allow of the inlet of water or other liquid under pressure.

Fig. 1 of the accompanying engravings shows, in longitudinal section, a water bearing applied as the under bearing for the shaft of a screw propeller. Fig. 2 is a section of fig. 1. A is a metal case, of the form shown in the sectional view, fig. 2. It is formed on the interior with a central cavity, into which water is admitted under pressure through a pipe *b* connected with a force pump. *c, c* are quadrangular cells, more clearly shown at figs. 3 and 4, extending upwards from the central cavity to the sides and ends of the case. *d, d* are walls or partitions between the cells. These walls or partitions may be made of lignum vitæ, so as to resemble the present system of supporting screw propeller shafts, and thus allow of a certain portion of the weight, if necessary, being borne by the bearing. Passages are formed in the partitions at both ends of the case. These passages are not carried in the same line, but are made to break joint. They are also gradually reduced in width from the central cavity outwards. B is the upper bearing, lined with blocks of lignum vitæ or other hard wood, and constructed in the usual manner. The upper and lower bearings are surrounded by hoops or straps C C, secured together by bolts and nuts D D. E is the screw propeller shaft, and F the screw. The weight of the shaft and screw being ascertained, water, under a pressure sufficient to overcome the whole or part of that weight, is forced through the inlet pipe into the central cavity, from which it circulates through the cells one after the other, slightly raising the shaft and interposing a film of water between it and the interior of the case, and finally escaping in thin sheets from the ends and sides of the case. In adjusting the upper bearing, allowance must be made for the raising of the shaft in the lower bearing, as above explained.

Fig. 3 is a cross section of a rolling mill fly-wheel shaft and of a water bearing for the same. Fig. 4 is a plan of the bearing. A is the case, *a* the central cavity, *b* the pipe for the admission of water, *c, c* the cells, *d, d* the walls between the cells, the passages through the walls of the cells are not shown. B is the fly-wheel shaft, and *e, e* bolts and nuts for securing the case A to the foundation D. The upper bearing is dispensed with, the weight of the shaft and parts connected with it being sufficient to keep it in its place.

According to the shape of the surface to which the bearing is to be applied, so must its shape be altered. For instance, if the surface be flat, so must the interior of the case with the central and cellular compartments be flat also. The walls of the cells may be made of lignum vitæ, or other hard wood, letinto the case, so that, in the event of the pressure of water failing, the shaft might revolve upon the wood.

LONDON FIRES.

Probably most of our readers remember that the Mechanics' Magazine for a great many years inserted annually Mr. Baddeley's report on London Fires. At last the report grew to such dimensions that we were unable to find space for it in our columns. Besides, it was considered by some to be scarcely suitable to a work devoted to engineering progress. The document on London Fires in 1862 will be found in this week's *Building News*—a journal devoted both to the production and preservation of buildings. It contains the usual analysis of the causes, character, and results of the fires in London during 1862.

The report says that the total number of calls given at the fire-engine stations in 1862 was 1,543; of these 1,303 were put down as fires, 129 were chimney fires, and 111 false alarms. Although there is an increase in the number of fires, and some few of them have been of considerable magnitude, it is gratifying to know that, upon the whole, a considerable amelioration has taken place in the character of these calamities during the past year. The number of fires, 1,303, is an increase of 120 upon the previous year, and an increase of 497 upon the average of the last twenty-nine years. This increase is, however, more apparent than real, arising, in a great measure, from the number of trifling accidents, which are now put down as "fires," that used formerly to be called "false alarms."

The number of fires at which the premises were totally destroyed is said to be 33; seriously damaged, 288; and slightly damaged, 982. This classification, which is wholly arbitrary, gives but a very imperfect idea of the real character of the fires; an approximate estimate has, therefore, been made of the damage done at each, by which it appears that the number of fires at which the damage done was merely nominal, or

Under	£1	392
"	10	378
"	50	223
"	100	118
"	500	106
"	1,000	48
And upwards		38
		1,303

Of these fires, 354 were extinguished by the inmates themselves, 366 by the inmates with casual assistance, 569 were extinguished by the the firemen, and 14 were self-extinguished. Upon 45 occasions the inmates themselves applied for the firemen's aid, in 315 cases the first call was given by the police, and in 912 cases by strangers. Upon 31 occasions the firemen were summoned to fires in outlying districts by means of the eelectric telegraph.

A glance at the foregoing facts will make it evident that the majority of last year's fires in the metropolis were of a very insignificant character.

After giving an account of the distribution of fires during 1862, buildings insured and uninsured, and the occupancy of the premises in which the fires occurred, the report says there is scarcely any circumstance connected with fires more interesting, or more instructive, than their *causes*. It is now nearly twenty years since I drew attention to the small amount of care that was given to this subject by the fire-brigade. It is quite true that the origin of fires is often involved in considerable obscurity, and requires more ability for its unravelment than falls to the lot of those upon whom this duty devolves; their superficial method of investigation seldom penetrating far enough to probe out deeply-hidden causes. The systematic regulations of the fire-establishment often necessitate the reporting of fires before the cause can possibly be ascertained; accordingly, it is put down as unknown, and there the matter ends. In the annual report of the Superintendent of the Fire Brigade for last year, no less than 493 fires are put down to *unknown* causes. Under the head of doubtful 10, and incendiarism 3, are included all the wilful fires of the year. A very slight knowledge of the subject will suffice to show the inaccuracy of these returns. Impossible causes of fire are frequently reported; thus, in December last, a fire was said to be caused by the ignition of *nitric acid* by *friction*. Another fire, only an hour previous, was reported, cause *unknown*, the damage done being "four cases of *nitric acid* taking fire and being destroyed, and several others damaged." Both fires occurred in the street, in the waggons of Messrs. Pickford and Co., the well-known carriers.

Much care has been bestowed upon the following analysis, which (although far from perfect) gives the proximate causes of a large proportion of last year's fires, which, it will be seen, are much of the usual character; bearing out the remark of Dr. Winter, in his "Curiosities of Civilization," that, "among the more common causes of fire (such as gas, candles, curtains taking fire, children playing with fire, stoves, &c.), it is remarkable how uniformly the same proportions obtain from year to year. We are informed by the Post Office authorities, that about eight persons daily drop their letters into the post without directing them—we know that there is an unvarying per centage of broken heads and limbs received into the hospitals—and here we see that a regular number of houses take fire, year by year, from the leaping out of a spark, or the dropping of smouldering tobacco."

It may, perhaps, excite some surprise, to find how many fires are attributable to the last-named cause. The greater number of these fires occur in the tap-room, in the skittle-ground, or before the bar of publichouses and beer-shops. The remains of a pipe of tobacco, the end of a cigar, or an unextinguished fusee thrown carelessly into the street, is frequently blown down an area, or into the basement of buildings, where, meeting with combustible matters, a conflagration is commenced. In the greater number of such instances the damage done is trifling; sometimes, however, it is otherwise, and two of the largest and most destructive fires of 1862 originated in skittle-grounds from unextinguished tobacco. The most painful part of the subject is the very large number of fires that are well known to have been wilfully occasioned, as well as those that have been suspicious in their origin, and the very few instances in which the perpetrators have been brought to justice. It must be confessed there is a delicacy on the part of the fire-offices, touching this question, which is most mischievous. At the same time, it is well-known that when a fire-office resists a claim they know to be fraudulent (even if the fire cannot be proved to be wilful), they receive but scant justice at the hands of juries. I have heard this accounted for on the ground of sympathy; that it was so difficult to find a jury of which at least one member had not had a fire! The crime of incendiarism is most frequently associated with others; and during the past year more than one well-known incendiary has received his deserts at the hand of justice for other villanies committed by him. Under a well-organized system of fire-police, it is probable that the greater number of incendiary fires would be nipped in the bud, the offenders fearlessly grappled with, and such crimes become almost as scarce in London as they now are in Gravesend, where but a few years since they were so rife. Prompt discovery and early extinction of the fire is fatal to the scheme, and often leads to the detection of the incendiary.

Considering the extensive use of lucifer-matches, it might have been supposed that a larger number of fires would have been traced to their agency. There is good reason to believe that many of the *unknown* fires have originated from the accidental ignition of these matches. Such accidents are preventible. Messrs. Bryant and May have produced a match which is ignitable only by a properly prepared surface, and are therefore not liable to accidental or spontaneous ignition. These matches have the further advantage of containing no phosphorus or poisonous materials, and do not give out any sulphurous or unpleasant odour. They are but of little more expense than the ordinary lucifer matches, and are much esteemed by careful housekeepers.

Mr. Baddeley concludes his very able report with the following comments:—The public are anxiously looking for the production of the Government plan for affording to the metropolis increased protection from fire. This natural anxiety has been by no means lessened, by the ambiguous and unsatisfactory answer recently given to Mr. Hankey's inquiry on the subject, in the House of Commons, by the Home Secretary. The result of the inquiry before a Committee of the House of Commons, last session, was the recommendation of a *Fire Police* for the metropolis. In my "Report on London Fires in 1844,"* remarking on the unsuccessful attempt of Lord Lincoln to introduce a Fire Bill for the metropolis, I observed that, "To an efficient and well-organized *Fire Police* we *must* come at last; and it seems strange, that, while so many of the provincial towns have for years past been thus provided, the metropolis should so long be left to shift for itself. The conduct of the police at fires has generally been of a very satisfactory description. In some instances great want of judgment has characterized their exertions; but in the majority of cases, their efforts have been most praiseworthy, and quite enough has been done to show that, if properly appointed and instructed, the police are calculated to render the most effectual assistance upon all occasions of fire, thereby refuting—were it not already strikingly refuted by the *Liverpool* practice—the fallacy of a statement recently put forth, that 'to add to the numerous and varied duties of the police that of *firemen*, would only be to confuse them.'" This opinion expressed by me nearly twenty years ago is now becoming general.

Prior to the appointment of the Parliamentary Committee, the Insurance Companies had officially notified to Government their desire to transfer to some properly constituted body (*approved by them*) the fire-service of the metropolis. When before the committee, however, they expressed themselves not unwilling to continue their fire-engine establishment on an extended scale, if Parliament would grant a subsidy for that purpose. Many persons doubted the sincerity of their avowed intention to give up their present establishment; and it is pretty certain they will not do so, unless they are permitted to have a very large share in the control and management of any new organization.

They have been increasing the number of their men and engines, and have entered into fresh contracts with their engine-makers for one, two, or three years, showing a strong belief on the part of the Insurance Companies that some time may yet elapse before any satisfactory arrangement shall have been completed. And it has leaked out that the proposal to relinquish their fire-engine establishment was a proceeding, on the part of members of the younger offices, that was not approved of by the older ones, who are desirous of keeping the matter in their own hands. The original movers in the affair, now finding that they will not be permitted to control any new organization, are doing their best to lay the spirit they have raised, but they have gone too far to retract, and they may, perhaps, be compelled to accept the Government measure. The Insurance Companies now say that their fire-engine establishment is sufficient for their purpose; and if the suburban districts require better protection, they must provide it themselves.

The public, however, are not likely to put up with such a state of things, after the late agitation and inquiry, but will look for a systematic and well-organized protection, independent of insurance interests. The employment of steam fire-engines for land service has not hitherto proved economical; this has arisen partly from the peculiar construction of the machines, which are evidently of a kind not adapted to the work, but more particularly from the reckless running to which they have been subjected. In the last annual report of the Superintendent of Brigade, he says, "I am now enabled to have at least one land steam fire-engine, with steam up, at almost every fire." It is very well known that the steam fire-engine is not required at "every fire," nor yet at one fire in fifty. It was recently stated in a local paper, that last year "the steam fire-engine had attended forty-five fires, at which the damage was under £10; thirty-eight fires at which the damage was merely nominal, or under twenty shillings; at eighteen chimney fires; and at seventeen false alarms."

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* Mechanics' Magazine, Vol. 42.

The consequence of this reckless running has been excessive wear and tear, necessitating continual visits to the repairing shop. The first land steam fire-engine of the fire brigade was used up in ten months; its successor, after twenty months' running, was found to require very extensive and costly repairs. A striking contrast to all this is furnished by Mr. Braithwaite's steam fire-engine the "Comet," built thirty years ago, which, without requiring any important repairs, is still in good working order at Berlin. Notwithstanding these discouraging circumstances, quite enough has been done to show that, if properly constructed and fairly used, steam fire-engines may be employed for extinguishing serious fires in the metropolis with advantage and with economy.

But prevention is better than cure; and the first object should be to establish in the metropolis such a fire service as will ensure assistance being given in all localities within ten or fifteen minutes after the first discovery of a fire, to be promptly followed by means equal to the requirements of the occasion. Under such a system serious fires would be greatly diminished both in number and extent.

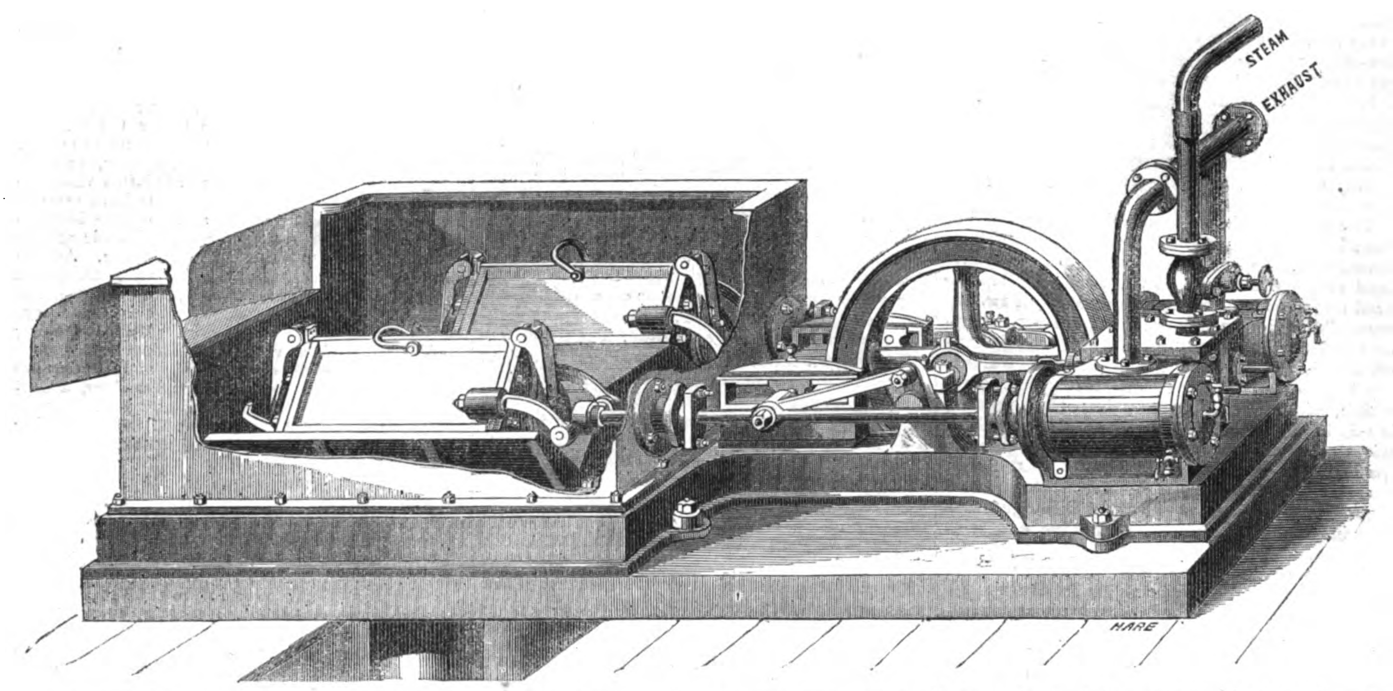
SCOTTISH SOCIETY OF ARTS.

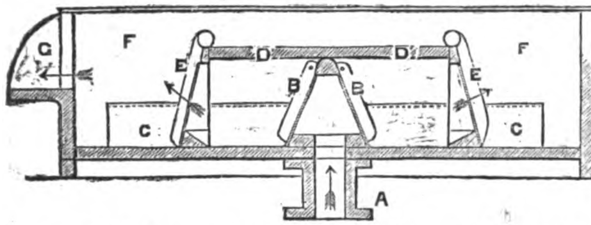
At the ninth meeting of the session of the Royal Scottish Society of Arts, in Edinburgh, on Monday, Mr. William Paterson, C.E., gave a description of an improved signal and method of working single lines of railway without accident. The method suggested by Mr. Paterson was, carrying out the suggestion of Captain Tyler in his report on the Winchburgh railway accident, that main signals, as well as distant signals, ought to be placed at both ends of single lines; that distant signals, with the necessary gearing, be placed from 500 to 600 yards distant from each connection; that main signals be placed at the point where the two lines begin to converge to the point of junction, whether at crossing places or single lines, or where the double line is closed in one line. These last-mentioned signals it is proposed to improve by making them locked signals. The pointsman at either end would have full control of the respective distant signals, but not so of the main signals. In working, should an engine or train approach one end of the single line, and the pointsman, finding that it could not be let on (he not being in possession of the handle for opening the main signal) then in that case he would turn the distant signal to caution, and thereby permit the engine or train to draw in between the distant and main signals, the former being turned to danger so soon as the engine had past within it—in that way protecting the standing engine or train—and then so soon as the pointsman received the handle of the main signal (which could be carried along the single line either by the engine-driver or by the guard of a train, or by a pilot-engine) he would open it and permit the train or engine to proceed. The paper was remitted to the committee.—Mr. Joseph Polson, engineman, gave a description of a machine for blacking and brushing boots and shoes. The machine, he said, is very simple. The motive power is supplied in the same manner as in the ordinary turning-lathe. Brackets fixed to the frame support a double crank-shaft, from which the different brushes obtain their motion. At the operator's left hand is the dusting brush, a few moments' application to which is the first stage of the process. At the right hand is the blacking brush, which is fed from a small box, and by means of a connection rod, worked from the front of the machine, the supply is presented or withdrawn. The boot or shoe, so prepared, is then placed under the polishing brushes, steadied upon a small self-adjusting platform. The brushes, which are hollowed to suit the rounded shape of the boot or shoe, move horizontally with great rapidity, closely imitating the action of the arm. The brushes give about 300 strokes per minute, being about five or six times the number produced by a strong hand and arm. They are, moreover, given with perfect equality and steadiness, and with a capability of sustaining the work for any length of time. The brushes, which are worked from the double crank-shaft by means of connecting rods, move in the grooves of a framework supported by brackets. The inventor then exhibited the machine in operation. The paper was remitted to a committee for consideration.—Mr. Edward Sang communicated a description of a new horizontal windmill, invented by Mr. James Laird, caum maker, Forfar. Mr. Sang also gave a description of two new gravity escapements, invented by Mr. Henry Kerr, clock and watchmaker, Dundee. Both papers were remitted to committees.—Mr. Alexander MacLattie, F.C.S., lecturer on chemistry, Glasgow, gave a description of a new apparatus for aerating water distilled from sea water, invented and patented by Messrs. Chaplin and Russel. The thanks of the meeting were awarded to Mr. MacLattie.

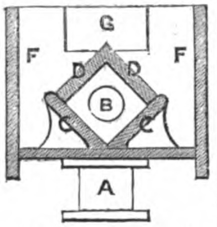
NEW THEORY OF STEAM GENERATION.

On Monday a Paper was read at the Liverpool Literary and Philosophical Society, accompanied by numerous experimental illustrations, "On a New Theory of the Generation of Steam, with an Explanation and Imitation of the Phenomena exhibited by the Geysers of Iceland," by E. J. Reed, Esq. The author commenced by remarking, that as a comparative stranger to the society he should not have ventured to put forward in their presence a new theory of steam generation had the theory been his own; but he felt sure that they would be glad to receive some account of what was, in fact, the result of experimental investigations that had been carried on for a series of years by a very distinguished townsman of theirs, Mr. Charles Wye Williams, whose labours had tended largely not only to distinguish Liverpool in the world of science, but also to benefit it greatly in a commercial sense by the establishment, as early as 1823, of steam trading vessels running between Liverpool and Dublin. The author next proceeded to point out the various and contradictory uses of the words "steam," "vapour," "vaporization," "evaporation," and "ebullition," which are to be found even in standard works of science, quoting from Dr. Thomson, Dr. Whewell, the writers of the *Encyclopædia Britannico*, and other authors, and stated that as a first step towards giving soundness, consistency, and utility to our knowledge of this subject, Mr. Williams had swept away all that jumble of competing and conflicting phrases, and had given to each of these words its distinct and legitimate signification. He showed that, from Dalton onwards, writers of the greatest eminence had admitted the absolute identity of vapour and steam, and that the only true signification of the word "vaporization" (as applied to water) is the conversion of water into vapour, that of "evaporation" being the escape of vapour from the water, and "ebullition" merely that particular mode of evaporation which arises from the aggregation of vapour into bubbles before and during its escape. The fiercest jet of steam is, in fact, nothing more or less than a compact stream of the self-same vapour that rises daily like incense from flower and field and sea, and floats in such beauty and splendour above us that an inspired writer was constrained to ask, "Dost thou know the balancing of the clouds, the wondrous works of him who is perfect in knowledge?" Strange to say, however, most of our philosophers, when they had come to study steam generation, had forgotten the familiar processes of vaporization and evaporation, and propounded the doctrine, that the effect of applying heat to water was no longer to vaporize the water, but to heat and expand it, and cause it to circulate until it all became of the elevated temperature of 212 deg. Then, and then only, did the formation of steam commence. The author then went on to show, by numerous experimental illustrations, that the first effect of applying artificial heat to water is, not to heat the water, as such, but to convert a certain portion of it into vapour, just as on a larger scale the natural heat of the sun converts the water of the earth into vapour, and brings about that magnificent meteorological paradox which the comprehensive eye of King Solomon discerned when he exclaimed, "All the rivers run into the sea, yet the sea is not full; into the place from whence the rivers came, thither they return again." When the subject first came under the author's notice, Mr. Williams drew his attention to the fact, that the rise of the generated vapour, and its diffusion through the liquid, were plainly visible to the eye—a discovery which seemed to have escaped all previous experimenters, and to have been reserved as a great reward for the scientific ardour and research of his friend, Mr. Williams. At this point of the paper, Dr. Edwards, the able analytical chemist of Liverpool, exhibited a most beautiful experiment illustrative of this discovery, by means of an electric light. On heat being applied to a glass vessel containing cold water, instead of the series of ascending and descending currents described by all previous writers, a continuous movement *upwards* of cloud-like vapour was made visible to the audience. After explaining this discovery at length, and demonstrating that the movements made visible were those of vapour, and not of heated currents of water, the author drew several important inferences from the phenomenon, such as that it is untrue to say, as many authors do, that vapour is formed at the *surface* of water only; that, water, even when of a low temperature, does not *condense* vapour, *i.e*, reconvert it into water; that water is capable of containing, and, when what is called warm or hot, does contain, uncondensed vapour or steam. These several doctrines were further illustrated by experiments (admirably carried out by Dr. Edwards), and their discovery, the author believed, rendered a revision of the common theory urgently necessary. By elaborate reference to the writings of Dalton, Faraday, and others, he further showed, that, apart altogether from the special experiments then considered, there were good philosophical grounds for urging such a revision. In referring to Dalton's doctrine of gaseous diffusion, and its bearing upon the new theory, the author mentioned incidentally that there was a peculiar fitness in the circumstance of the present discovery proceeding from Mr. Williams, seeing that in early life, and before Dalton announced his discoveries, his venerable friend was a pupil of Higgins's, whom Davy acknowledged to be the first discoverer of the atomic theory in its modern form. From the lips of that philosopher, he (Mr. Williams) had listened to the earliest enunciation of that theory, and later in life not only became an earnest student of Dalton's writings, but delivered at Manchester a lecture treating largely of gaseous diffusion, at which Dalton himself presided, and which received the full approbation of that illustrious man. The author finally referred to a class of phenomena to which little attention had been given, concerning which Mr. Williams had made many remarkable discoveries, and which was, in the author's opinion, inexplicable under any other theory than that which he had then explained, that class of phenomena being principally the ebullition excited by the introduction of foreign substances into masses of water to which considerable heat has been applied. The treatment of this part of the subject involved a discussion of "the boiling point" (and in reference to it Dr. Edwards again exhibited a brilliant series of experiments). The author concluded by saying he felt confident, that even while laying aside all that personal regard which the long and honourable residence of Mr. Williams among them must have excited, the audience would agree with him in believing, that as students and lovers of science, they must heartily admire both the zeal and the genius which he had brought to bear upon that profound and intricate subject. It was a subject in connection with which great successes had been achieved and great reputations made; but when he compared the confused and conflicting doctrines enunciated in our existing works with the clear and harmonious principles now presented to us in Mr. Williams's work, "On Heat in its Relation to Water and Steam," (lately published by Longman and Co., of London), he could not help thinking that his name deserved, and would ere long attain, a place as high and as illustrious as those of even the most distinguished discoverers in that beautiful and profound branch of science. At the close of the paper Mr. Reed explained the perfect manner in which the action of the Geysers of Iceland was accounted for by Mr. Williams's new theory, illustrating the subject by the exhibition of a powerful artificial

NORTON'S V-SHAPED PUMPS.







Geyser, which had been prepared by Mr. Williams himself, and by which the violent and intermittent, but very copious discharges of steam which occur in the boiling springs of Iceland, were imitated in a most remarkable and interesting manner.

At the conclusion of the Paper a discussion ensued, in which several gentlemen took part, and a vote of thanks having been carried by acclamation to the lecturer, and also to Mr. C. Wye Williams, who was present, the meeting was adjourned at a late hour.

NORTON'S PATENT V-SHAPED PUMPS.

The woodcuts given above represent a perspective view of a steam-pump of a simple construction, as regards both the mechanical details and facility of access to the working parts. Besides these advantages, the unavoidable wear and tear of the moving parts incidental to all metal surfaces tend rather to keep the pump in repair, instead of deteriorating it. As no packing is required, or the attention of a skilled labourer necessary to keep the machine in working order, its advantages recommend its adoption under circumstances where pumps of a more complicated description would be scarcely applicable.

The amount of power required to raise a certain quantity of water to a given height is theoretically fixed; the difficulty in engineering being to make working machinery approximate as nearly as possible to scientifically ascertained data, and when that approximation has once been attained, to have a machine applicable to every-day use that shall maintain its qualities without the constant supervision and "doctoring" that the "wear and tear" natural to all materials usually involve—in fact, to construct something that shall always wear itself true, instead of wearing "out of truth." Results when once obtained by scientific experiments may be reproduced *ad infinitum*, if the right means be taken; but the great obstacle o continuous repetition is the want of durability of the materials used; and their lasting powers, in good working order, are the limits of the truly effective action of any machine. Instead of using a cylinder and plunger, or piston, which requires packing, and is constantly *wearing loose* and becoming leaky by continuous action, the inventor substitutes a V *bed and a moving* V working therein, which does *not* require packing, and is constantly *wearing true*, even supposing the original to be imperfect, until the material of which it is made is actually worn away.

The accompanying sectional diagrams will explain how this is attempted. A is the suction pipe of the pump leading to the well or other place from which the water is required to be raised. B B, are two valves opening right and left, so as to allow the water to pass out in the direction indicated by the arrows, and forming part of a centre piece in the V-shaped bed C. D is a sliding V, having two top sides and two ends, also provided with valves E E; the two top sides combined with the V bed, forming a diagonal square box opening right and left into a tank F, having an overflow spout at G, from which the water is discharged. The moving V and the V bed when together, form a rectangular chamber closed in by end pieces forming part of the moving V. All the valves are of the simplest form of hanging flap valves, and are at any time got at in case it is required, by merely lifting the box D, which can be done in the heaviest pumps by a labourer without having to unscrew a single bolt or nut to interfere with any working parts, and in replacing the box, it would be impossible to do so in any but the right position, even if it were desired.

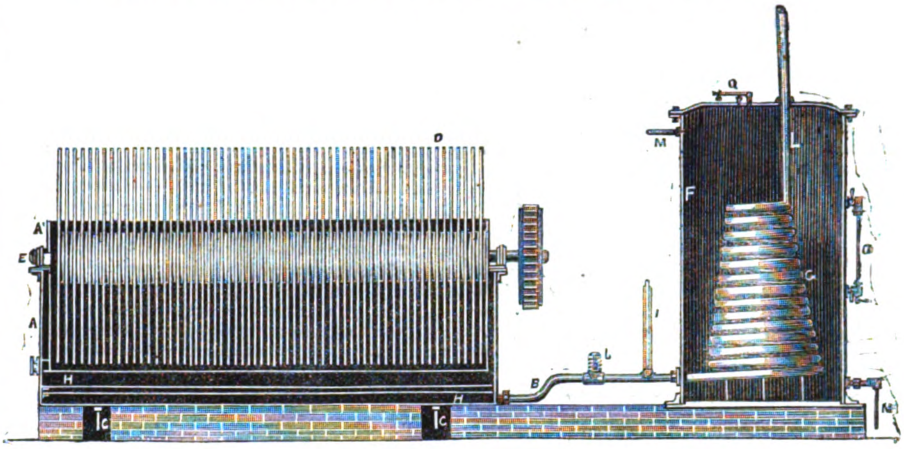
The action of the pump is as follows:—If the box D is pushed towards the right hand, it forms a vacuum on the right-hand side between the anti-piece and the end of the moving V, and any water on the left-hand side is expelled through the valve into the tank F. By moving it towards the left, a vacuum is formed to the left, and the water on the right is expelled into the tank; in both cases the surplus water in the tank escaping by the overflow spout G, so that by imparting a reciprocating action to the box D a constant flow of water *upwards* is maintained in the pipe A, and a constant overflow from the discharge spout G. In the two pumps shown in the engraving the reciprocating action is given to the pumps by a pair of steam cylinders, having pistons, the rods of which are connected with the moving V's, the whole being self-contained on the same base-plate. The results obtained by these pumps are said to be very satisfactory. For force pumps it is merely necessary to cover in the top of the tank F, and convert the spout G into a pipe leading to any place required.

NEWNAM'S APPARATUS FOR CRYSTALLIZING AND EVAPORATING.

Mr. J. Newnam, of Crayford, Kent, has obtained a patent for an invention for "improvements in apparatus for crystallizing and for evaporating." This invention consists in the combined employment of a closed pan with steam inlet and steam and condensed water outlet, of revolving discs which revolve partly in the atmosphere and partly in the matter being operated on, and of a vessel containing a worm or pipes communicating with the pan, and through which steam is made to pass. A gauge is fitted on the pipe which communicates between the vessel and the pan, and also a safety valve.

The accompanying engraving is a longitudinal section of an apparatus for crystallizing and evaporating, constructed according to this invention. A is the closed pan, B is the steam inlet, and C C are steam and condensed water outlets. D D are discs mounted on a shaft E, revolving partly in the atmosphere and partly in the matter being operated on, which is contained in the vessel A^1. F is a closed vessel, containing a worm or pipes G, through which steam is made to pass to the pan A. H H are perforated plates in the pan A for distributing the steam uniformly over the whole interior surface of the pan. I is a gauge, and a safety valve is on the pipe which communicates between the pan A and the vessel F. A safety valve is likewise fitted on the side of the pan A. The matter to be operated on is supplied to the vessel A^1, the bottom of which forms the top of the pan A. Steam is admitted into the worm G from the pipe, and is reduced to the pressure required by cold water supplied to the vessel F when required by the pipe M. N is an outlet pipe fitted with a cock for drawing off water from the vessel when the steam does not require attemperating. The height of the water in the vessel F is indicated by the gauge O, and the pressure of the steam is shown by the gauge I. The steam from the worm G passes through the pipe B into the pan A, all increased pressure being prevented by the safety valve J. On entering the pan the steam is uniformly distributed therein by means of the perforated plates H, the pan becomes heated, and the heat is transmitted to the matter under operation, which is kept agitated by the revolving discs D D; the liquid portions are gradually evaporated, and the matter, where capable of crystallization, crystallized. The steam which becomes condensed in the pan passes off by the outlets G G. The vessel F is furnished with a safety valve Q. Instead of causing the steam to pass through the worm G, and the cold water through the vessel F, as hereinbefore described, the steam may be made to pass through the vessel and the cold water through the worm.

NEWNAM'S APPARATUS FOR CRYSTALLIZING AND EVAPORATING.

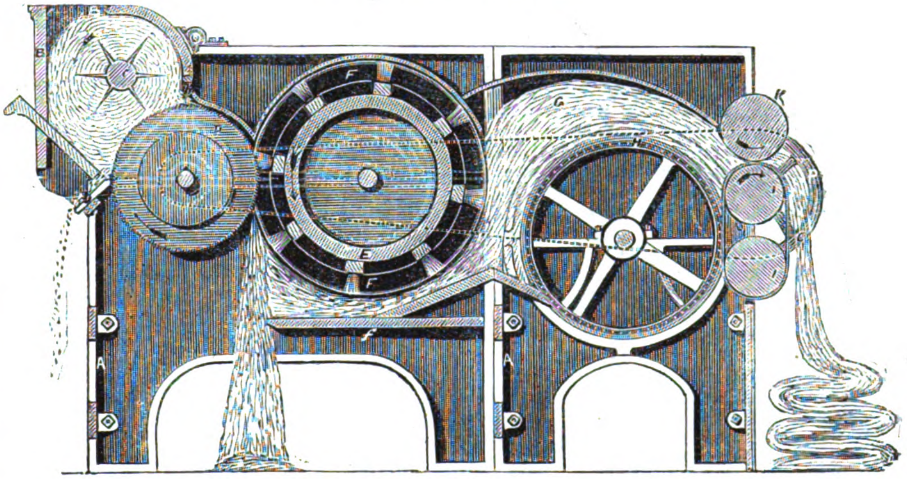


EMERY'S MACHINERY FOR GINNING COTTON.

Mr. H. L. Emery, of 72, Sloane-street, Chelsea, has just patented an improvement in machinery for ginning cotton. The object of this invention is so to improve the saw gin as to effect the ginning of long and short staple cotton in a more efficient and economical manner than heretofore, and effectually to remove the sand and dust from the cotton. At the front part of the machine the hopper is mounted on a hinged joint, as usual, to allow of its position being adjusted by the attendant for the purpose of regulating the action of the saws upon the staple. Within the hopper is mounted a spiked roller, its use being to lap around it the cotton as it is fed into the hopper, and thereby to present the staple in the form of a roll to the action of the saws. This roll may receive motion through gearing from the saw shaft, but it is preferred to mount it loosely in bearings formed by elongated holes in the ends of the hopper. The inner side or breast of the hopper is formed as usual of upright bars which constitute a grid. Between these bars the saws (set at equal distances apart on a common shaft) project to take hold of the roll of cotton, and detach the fibres from the cotton seed. As the saws revolve they give rotary motion to the roll of cotton in the act of drawing out the fibres therefrom, and as the cotton is withdrawn from the hopper by the saw teeth, the cotton seeds are discharged through the bottom of the hopper. The saw teeth, as fast as they become charged with cotton fibres, are stripped by a rapidly revolving brush cylinder, which is mounted in a chamber in the rear of the line of saws. This brush cylinder, by its rapid rotation, creates a blast of air that passes up between the cylinder and an inclined conducting board, on to which the cotton is delivered; from this board the ginned cotton passes (assisted by the blast) into a taper-mouthed air-trunk connected with the air-chamber. In this air-trunk a drum of wire gauze is mounted horizontally. The cotton, as it enters the air-trunk, is taken up by the drum, which receives a slow axial motion. The drum, in its rotation, carries the cotton upwards in the form of a thin sheet, and presents it to the action of the blast, so that the sand and dust contained in the cotton is discharged therefrom, and falls through the wire gauze drum to the ground. The cotton, as it passes round, is stripped from the drum by a stripping roller, and passed between a pair of smooth rollers, which deliver it in a condensed form, and in a continuous length out of the machine.

A is the main framing of the machine, at the front of which is a hopper B; this hopper is mounted on a hinged joint *b*, capable of receiving an endway movement to allow of the position of the hopper being adjusted by the attendant for the purpose of regulating the action of the saws upon the staple. Within the hopper is mounted loosely a spiked roller C, its use being to lap around it the cotton as it is fed into the hopper, and thereby to present the staple in the form of a roll to the action of the saws. This roll may, if desired, receive motion through gearing from the saw shaft, but it is preferred to mount it loosely in the hopper, and make it dependent for its rotation on the contact of the saws with the roll of staple.

EMERY'S COTTON GIN.



The bearings of the spiked roller consists of elongated holes in the ends of the hopper, the lower edge of the holes being of a segmental form struck from the axis of the saws, and the upper part being sufficiently concave to allow the roll of cotton to rise, and thereby escape a too severe action of the saws. The inner side or breast of the hopper is formed, as usual, of a series of upright curved bars *b*, which are set parallel to each other, and constitute a grid. Between these bars the saws D (set at equal distances apart on a square shaft) project to take hold of the roll of cotton, and detach the fibres from the cotton seeds. As the saws revolve they give rotary motion to the roll of cotton in the act of drawing out the fibres therefrom, and as the cotton seeds are stripped of the cotton by its withdrawal from the hopper by the saw teeth, the seeds fall out from the roll, and are discharged through the bottom of the hopper.

As fast as the teeth of the saw become charged with cotton fibres they are stripped by a rapidly-revolving brush cylinder E, which is mounted in a chamber F, in the rear of the line of saws. This brush cylinder, which is intended also to act as a blower, is closed at its ends by annular trough-shaped end plates, and segmental openings are made in the sides of the chamber F opposite the upper half of the annular trough to allow of an indraught of air to the chamber. The rapid rotation of the brush cylinder also draws air between the cylinder and a conducting board *f*, forming the bottom of the chamber, against which the cotton is thrown by centrifugal force. From this board the ginned cotton is carried by the action of the blast into an air-trunk G connected with the air-chamber F. In this air-trunk a drum of wire gauze H is mounted horizontally for the purpose of receiving the cotton on its surface in the form of a batt. To this drum a slow axial motion is imparted for the purpose of conveying the cotton as it is deposited upon the upper part of its periphery to an endless belt on a pair of stripping rollers I, I, and presenting a fresh surface to be coated by the cotton discharged into the air-trunk. The drum in its rotation carries forward the cotton in the form of a thin sheet, and presents it to the action of the blast, the only vent for which is through the wire gauze drum; the sand and dust contained in the cotton is therefore carried away by the blast, and falling through the drum H, is deposited on the ground. The cotton passes under a smooth pressing roller K mounted above the stripping rollers, by which means it is delivered in a condensed form, and in a continuous length out of the machine, as shown.

The use of the spiked roller is to support the feed of cotton in such a manner that it will ensure an equable rolling motion of the mass of cotton in the hopper, and thus prevent the unequal drag of the saw teeth upon different parts of the feed, which inequality of drag occasions the formation of twists and knots, and the consequent cutting and destruction of the staple.

A further important advantage incidental to the use of the spiked roller which forms a supporting core to the roll of feed cotton, is that it enables the machine to be driven either at high, low, or variable speeds without injury to the staple, and that with a considerably reduced expenditure of motive power as compared with saw gins fed in the ordinary manner. The ends of the brush cylinder are closed, and air enters the machine past the closed ends of the cylinder. By this arrangement, the liability of the cotton to accumulate about the axle of the cylinder is removed, and the common danger of fire resulting from the friction on such accumulation of cotton is also removed.

In order to adapt the machine when set for short staple to act on long staple cotton, every alternate saw is removed and replaced by plain discs of the same diameter. By thus increasing the distance between the saws, no two sets of teeth can by any chance actu pon the same individual fibres, and therefore the cutting of the long fibres by the saws will be effectually prevented.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

At the ordinary meeting, on April 7th—E. W. Binney, F.R.S., F.G.S., president, in the chair—a Paper was read, entitled "Note as to two Events in the History of Steam Navigation," by W. J. Macquorn Rankine, C.E., LL.D., F.R.S., Hon. Member of the Society.

1. An interesting Paper was lately read to this society by Mr. Dyer, containing a history of a series of important events in the progress of steam navigation.

2. It is to be regretted, however, that the author has noted, either very slightly or not at all, what appears to have been an event of paramount importance in the first adaptation of the double-acting cranked steam engine to drive a paddle-wheel. Before that adaptation was made, the success of all attempts at steam navigation, such as those of Jouffray, Rumsey, Titch, Miller, and Taylor, &c., had been only temporary, because of the rudeness of the machinery for communicating motion from the piston to the shaft.

3. The first adaptation was unquestionably accomplished by William Symington in 1801, as is proved by authentic documents which have been published by Mr. Woodcroft in his "Origin and Progress of Steam Navigation." Symington, instructed by the failure of the ratchet-work engine which he had made for Miller's boat, fitted up the "Charlotte Dundas" in 1801, with a double-acting horizontal cranked engine, and this made her what Mr. Woodcroft has justly called "the first practical steamboat." Her speed, when running alone, and not towing other boats, was six miles an hour.

4. The use of this vessel was abandoned, not from any fault in her construction or working, but because the directors of the Forth and Clyde Canal feared that she would damage its banks. Yet the man in all Britain who possessed, at that time, the greatest practical experience of the working of canals—the Duke of Bridgwater—was not deterred by any such apprehension from ordering, in 1802, eight similar vessels, from Symington, to be used on his canal.

5. The death of the Duke of Bridgwater, early in the following year, prevented the execution of that order. But Symington had evidently done all that lay in his power, and all that was necessary, to convert the steamboat from an awkward piece of experimental apparatus to a practically useful machine; and the honour paid to his memory ought not to be lessened because the career of his invention was cut short by a misfortune.

6. There is nothing in this to detract from the honour which is justly paid to Fulton, as having been the first to practise steam navigation on a great scale, as a commercially profitable art.

7. Another event passed over in the Paper to which I have referred, is the first introduction of commercial steam navigation into Europe, which was effected on the river Clyde, in 1812, by Henry Bell, as is proved by documents cited in Mr. Woodcroft's work, already referred to.

Dr. R. Angus Smith said that he had been using an amalgam of sodium for the production of hydrogen. When doing this it was found that the amalgam had become one mass of crystals. These crystals are fine needles or prisms of considerable length; some may be traced in the tangled mass for about half an inch; they present hollow ends, although it was not possible to trace this hollowness through the whole length of the crystals. They are hexagons, and contain 9·47 per cent. of sodium; an excess of mercury remains; 10·3 per cent. would be equal to 2 at. of mercury and 1 of sodium. He had not seen any notice of an amalgam of a similar composition. It can be examined only through glass, as it rapidly absorbs oxygen from the moisture of the air, and cannot be retained in the air many seconds without changes being perceived. If this change be examined under a microscope, bubbles of hydrogen are seen to rise from every corner, extremely minute certainly, so that many millions would be required to cover a square inch, but affording one of the most convincing and direct proofs of the existence of moisture. This property may in many cases be found to be of value. The inclination to combine with oxygen when dry seems comparatively slight.

MIDDLE LEVEL DRAINAGE.

At the meeting of the Institute of Civil Engineers, on Tuesday last, the Paper read was "Account of the Coffer Dam, the Syphons, and other works, constructed in consequence of the failure of the St. Germain's Sluice of the Middle Level Drainage," by Mr. Hawkshaw (President Inst.C.E.).

The St. Germain's Sluice was situated at the confluence of the Middle Level main outfall drain with the River Ouse, near the upper end of the Eau Brink Cut. This drain was made in 1847, from the designs, and under the direction of Messrs. Walker, Burges, and Cooper. It was deepened by them in 1857, and then had, at the lower end, a bottom width of 48 ft., the side slopes being 2 to 1. The level of the bottom was 7 ft. under low-water spring-tides in the river, and the rise of the tide at that point was about 19 ft. at spring-tides, the sill of the sluice being 6 ft. below low-water spring-tides. The bed of the drain was of soft blue clay, and the sides consisted of variable thicknesses of soft blue clay, peat, yellow clay, and surface soil.

On the 4th May, 1862, the St. Germain's Sluice gave way, thereby admitting the tidal waters, which ebbed and flowed throughout a distance of upwards of 20 miles. A few days afterwards the western bank of the Middle Level drain burst, about 4 miles from the sluice, by which 6,000 acres of land were inundated. Immediately after the failure of the sluice, the author received instructions to execute whatever works might be necessary to shut out the tidal waters, regardless of expense. The services of Mr. J. T. Leather were secured as contractor, who was ably aided by his assistant, Mr. E. P. Smith. Mr. Alexander G. Linn was appointed resident engineer. Subsequently, after the coffer dam was closed, finding it impossible to devote so much time to the works as he had previously done, at the author's request, the Middle Level Commissioners associated with him Mr. T. E. Harrison, who had since continued to act.

Before the author assumed the direction of the works, and directly after the failure of the sluice, an earth and cradle dam was attempted to be thrown across the drain, at about 500 yards from the fallen sluice. This was relinquished shortly after the permanent coffer dam, of pile-work, was commenced; which the author considered was the only plan likely to be effectual, and the site finally fixed upon for which was about 880 yards from the sluice. The coffer dam might be thus described:—Temporary piles were first screwed into the ground, upon which a staging was erected for the pile-driving engines. Two rows of sheet-piling, 25 ft. apart, were then driven transversely down the slopes of the drain on each side, from the centres of the banks to within 20 ft. of the bottom, leaving a central space of 88 ft. of coffer dam to be afterwards completed. In this portion of the dam the piles were placed in pairs on each side, 7 ft. 6 in. apart from centre to centre, and with a space of 7 in. between each pair. The grooves thus left were for the reception of sliding panels, to be used to fill up the intervals between the several twin piles. Waling pieces of whole timbers were fixed to the inside and the outside, both at the top and as near the level of low-water as possible. As the piles were driven, struts and ties were inserted, and strongly-framed raking struts were secured against the dam and against abutments of piles, backed with concrete, on the land. The panels were composed of timbers 7 in. thick, and of variable lengths, firmly bolted together, and further connected and weighted on one side by flat wrought-iron plates. In order to put these panels in place, a frame was erected, from which they were suspended, and from which they could be lowered, and raised, if necessary, by pulleys.

The rush of water through the dam was materially increased, when the piles for the panels and the walings were in place; so that, at times, the difference of level between the water on the two sides of the dam was considerable. Aprons, extending the whole width of the drain, and for some distance up the slopes, were formed on both sides of the dam, of sacks of clay, and of gravel, puddle, and stone. Only sufficient stone was deposited in the centre of the dam to stiffen the clay; but large quantities of puddle were repeatedly thrown in at slack water, most of which was washed away by the rush of water, which acquired a velocity of 8 miles an hour.

The first, or lower tier of panels, was 7 ft. deep, and pointed at the lower end, so as to be driven into the mud. Inasmuch as they could not be driven to the same depth, the second set was so arranged as to raise the panelling to the uniform height of low-water spring-tides. During these operations, sacks of clay and gravel were deposited on the inside and the outside of the dam; but, although the aprons were extended, only a few sacks of gravel remained in the inside. It now became clear that the water could only be excluded by shutting the dam at one operation. To accomplish this, the necessary panelling, which had to be 12 ft. deep, was suspended from the scaffolding, so as to be dropped into place at slack-water neap-tides, when the differential head for the dam to sustain was the least. On the first attempt to close the dam, three of the twin piles on the lower side gave way, releasing some of the bottom panels, after the tide had receded 3 in., and when there was a head of 8 ft. The other panels were readily lifted and removed; and sheet-piling was then driven up to the level of the lower waling pieces, thereby filling in the spaces between the broken piles. The second attempt, which proved completely successful, was postponed until the succeeding neap-tides; when the panels were dropped into their places in twenty minutes, at low-water of ebb tide, that time being more convenient, the difference of the head at high and low water not being considered of sufficient importance to counterbalance other advantages. After the panels were lowered, the inside of the dam was immediately filled with clay: sacks of gravel and clunch being deposited in the centre. So complete were the arrangements, that the raising of the dam was kept in advance of the rise of the tide, and before high-water the operation was completed, the dam not exhibiting the slightest indication of failure, or of weakness. The coffer dam was commenced on the 16th of May, and the tidal waters were shut out on the 19th of June, 1862.

During this time, the means to be adopted for the future drainage of the Middle Level received serious attention. After careful consideration, the author determined that, in addition to such drainage as could be obtained through Salter's Lode Sluice, the old outlet into the Ouse, syphon pipes should be laid over the coffer dam. This plan of discharging water was not to him novel, having pursued it in 1839, when engaged on the Manchester, Bury, and Bolton Canal. The syphons were sixteen in number, and were laid transversely across the dam, at an inclination of 2 to 1 at the sides, and horizontally over the top. Each end was terminated by a horizontal length, containing the upper and lower valves, laid 18 in. under low water of spring tides, the top of the syphons being 20 ft. above the same level. The total length of each syphon was 150 ft. The syphons were of cast-iron, 3 ft. 6 in. internal diameter, and the thickness of the metal was (excepting at the socket ends, where it was thicker) 1½ in. They rested on the top of the dam, and on inclined framework, supported on piles at the sides. Underneath the extreme ends of the syphons, sheet-piling was driven across the drain. Above the sheet-piling, the spaces between the inclined framework, to the under side of the syphons, were filled in with clunch, clay, and gravel, so as to form a solid and impervious embankment. The bottom of the dam, at the inlet and outlet of the syphons, was protected by substantial wooden aprons, extending across the drain; and a row of piles was driven on each side, inclining towards each other, and contracting the channel to a width of 60 ft., so as to keep the "wash" off the slopes of the drain. The upper, or inlet, valve consisted simply of a loose hanging flap of teak wood, working inwards as soon as the outward was the preponderating pressure. The lower, or outlet, valve was of cast iron, turning on a hinge at the top, and fitted with a balance weight, which was capable of resisting an interior pressure, but could be readily released when the valve was converted into a flap opening outwards. The reason for adopting two valves was for the purpose of enabling the syphons to be put into operation, either by exhausting the air, or by filling them with water; but at present only the former method had been tried.

The syphons were put into action by exhausting the air from the inside, by an air-pump having three cylinders, each 15 inches diameter with a length of stroke of 18 inches, worked by a 10-horse power, high pressure, steam-engine. Each syphon could be shut off, or be brought into operation at pleasure, by means of slidecocks, fixed on vertical pipes, communicating with a transverse horizontal pipe in connection with the air-pump. An overflow pipe showed when the syphons were full of water; and glass gauges were also attached to some of the syphons for the same purpose. The pipes were cast by Messrs. Cochrane and Co., and the steam-engine and air-pump were manufactured by Messrs. Easton, Amos, and Sons.

After the breach occurred, it became evident, that all attempts to stop it should be abandoned. The area flooded was surrounded by banks, which confined the mischief within certain limits. As soon as the coffer dam was completed, and the tidal waters were excluded, the breach was closed, by first tipping stone to form a footing for an embankment of clay to the level of the bottom of the drain, above which a small quantity of clunch was mixed with the clay, to stiffen and weight it. The total quantity of material used to restore the bank was about 25,000 cubic yards. The bottom of the drain, where the scour had taken place, was also repaired, and the banks generally were put in good order. After the breach was secured, the water on the inundated land was let off, through the Marshland Smeeth and Fen drain and the adjoining Marshland sewer.

In conclusion, the author remarked, that he believed the syphons would be found to answer all the purposes of a permanent sluice. They possessed, moreover, the advantage of not rendering the safety of a district dependent upon single pairs of gates; for it was clear, that any one or more of the syphons might be damaged or destroyed, without affecting the operation of the others, or endangering the district.

In an appendix tables were given, showing the quantities of the several materials used in the construction of the dam and syphons, as well as the results of the working of the syphons.

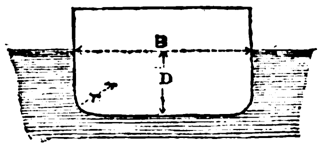
ON SECTIONS OF LEAST RESISTANCE FOR SHIPS OF LIMITED BREADTH AND LIMITED DRAFT OF WATER.*

As the friction of water along the submerged surface of ships forms an important part of the resistance to be overcome, it is desirable that this surface be the smallest possible consistent with other conditions.

The common problem of passing a curve of a given length through two points so as to enclose the greatest area between the curve and the straight line joining the points, may be applied to the construction of all vessels whose breadth and draft of water are not limited.

But there are many cases where both the breadth and draft of water are limited, it may be by the width of dock entrances and the depth of rivers. Then the problem becomes, to enclose within a rectangle of a given breadth and depth the greatest area with the least wetted boundary, that the enclosed area, divided by the wetted boundary, may be a maximum; for then, whatever form it may be considered necessary to give to the water lines, the vessel of this breadth and draft of water, with this midship section, these water lines, and with the narrow sections constructed on the same system, will have the greatest displacement or volume below water with the least surface for friction, and therefore the least resistance. In this sense I have called them sections of least resistance.

To construct these sections, the problem reduces itself to finding the radius of bilge, which, with the given breadth and draft of water, shall complete the section, whose area, divided by the wetted boundary, shall be a maximum.



Let B be the breadth of the vessel.
D the draft of water.
r the radius of bilge.

$$\frac{\text{Area of section}}{\text{Wetted boundary,}} = \frac{B\,D - 0{\cdot}429\,r^2}{B + 2\,D - 0{\cdot}858\,r} \text{ is to be a maximum.}$$

Therefore,

$$\frac{0{\cdot}858\,r\,d\,r \times \text{denominator} - 0{\cdot}858\,d\,r \times \text{numerator}}{(\text{Denominator})^2} = 0$$

$$\therefore r \times \text{denominator} = \text{numerator}$$

$$(B + 2\,D)\,r - 0{\cdot}858\,r^2 = B\,D - 0{\cdot}429\,r^2$$

$$0{\cdot}429\,r^2 - (B + 2\,D)\,r = -B\,D$$

$$r^2 - \frac{(B + 2\,D)\,r}{0{\cdot}429} = -\frac{B\,D}{0{\cdot}429}$$

A quadratic equation from which the radius r is found,

$$r = \frac{B + 2\,D - \sqrt{B^2 + 4\,D^2 + 2{\cdot}284\,B\,D}}{0{\cdot}858}$$

Examples.

When $D = 4\,B$ $r = 0{\cdot}114\,D$ when $D = \infty$ $r = \frac{B}{2}$
$D = 2\,B$ $r = 0{\cdot}23\,D$ $B = \infty$ $r = D$
$D = B$ $r = 0{\cdot}35\,D$
$D = \frac{1}{2}\,B$ $r = 0{\cdot}54\,D$
$D = \frac{1}{3}\,B$ $r = 0{\cdot}63\,D$
$D = \frac{1}{4}\,B$ $r = 0{\cdot}70\,D$

By describing sections in a rectangle whose breadth equals twice its depth, it will be found that

$$\frac{\text{Area of rectangle}}{\text{Wetted boundary}} = \frac{2\,D_2}{4\,D} = 0{\cdot}5\,D$$

$$\frac{\text{Area of semicircle}}{\text{Wetted boundary}} = \frac{\frac{1}{2}\,\pi\,D_2}{\pi\,D} = 0{\cdot}5\,D$$

$$\frac{\text{Area of best section}}{\text{Wetted boundary}} = \frac{2\,D^2 - 0{\cdot}43 \times (0{\cdot}54\,D)2}{4\,D - 0{\cdot}86 \times 0{\cdot}54\,D} = 0{\cdot}531\,D$$

showing that when the radius of bilge is 0·54 times the draft of water, there is a gain of about 6 per cent over the semicircular or rectangular section.

Professor Macquorn Rankine said that he had revised the mathematical investigation in Mr. Napier's Paper, and could corroborate its accuracy. Its practical utility arose from the fact that the whole, or nearly the whole, of the resistance to the motion of a well-shaped ship arose either directly or indirectly from friction. A theory based on that fact had been applied to practice in designing steam-ships and their engines by Mr. Napier and himself, in December, 1857, and subsequently, and in every instance with success. He had read a Paper giving a general account of the theory, and an explanation of the practical formulæ deduced from it, with tables of comparison between their results and those of experiment, to the British Association in 1861. That Paper was published entire in the *Civil Engineer and Architect's Journal* for October of that year, and, in part, in other engineering periodicals also.* The theory was connected with some researches on the motion of waves, which were read in abstract to the British Association, and in full to the Royal Society in 1862.

As might be expected in a theory whose practical application was only four years and a half old, various questions still remained to be settled by experiment. A serious obstacle in the way of obtaining exact experimental data as to such questions arose from want of precision in the indicator-diagrams of steam engines, especially in engines of rapid stroke, which was produced partly by the friction of the indicator, but chiefly by the oscillations of its spring. One of the best means of diminishing the extent of these oscillations, and the effect of friction at the same time, was to increase the stiffness of the spring and diminish the mass of the indicator-piston. He had seen at the International Exhibition an indicator (that of Mr. Richards) in which that principle had been adopted, and, so far as he could judge from having seen it in action two or three times, with very good results in point of precision.

A comparison of the diagrams given by a very accurate indicator applied to the engines of such vessels as the "Admiral," the "Athanasian," the "Lancefield," &c., would settle some very important points regarding the comparative advantages of straight and hollow water lines, &c. Unfortunately, when vessels were engaged in trade it was difficult to find opportunities for making scientific experiments upon them.

The special subject of Mr. Napier's Paper, however, was not one of those problematical points; for there could be no doubt that, to diminish a vessel's mean girth, as compared with her sectional area, was a certain means of diminishing resistance; that principle, indeed, had been admitted ever since friction had been recognized as one of the causes of resistance; and Mr. Napier's investigation showed how to carry that sort of diminution as far as possible under the circumstances stated by him—viz., a fixed extreme breadth and draft of water.

The importance of smallness of girth in diminishing resistance was strikingly shown in the case of the well-known match between the yachts "Titania" (now called the "Themis") and "America." The "Titania" was the smaller vessel of the two, and had the less capacity for carrying sail; and in order to make her speed equal to that of the "America," her friction ought to have been less in the same proportion with her capacity for carrying sail. But while the cross-sections of the "America" were nearly triangular, those of the "Titania" were formed by ogee curves of great concavity, producing a comparatively large girth relatively to her capacity; and although the "Titania" had a smaller midship section than the "America," the quantity called the "augmented surface," upon which the friction depends, was almost exactly equal in the two vessels, and hence the "Titania," having the less power of carrying sail, was beaten in the race.*

Professor W. Thomson said that he was glad to find that true principles as to the resistance experienced by solids moving through fluids were being applied in practice with such valuable results. The theory which had been hitherto commonly given in treatises on hydrodynamics, was founded on a calculation in which only the front part of the surface of the moving body was taken into account. It was no doubt convenient to neglect the action on the remainder of the surface; for to have included it in the account would have led to the awkward result *of no resistance at all!* Such a theory clearly is wanting in some essential. This we now know to be the reckoning of effects due to the viscosity of the fluid. A probable hypothesis as to the law of viscous force having been adopted, a perfect theory of the motion of a solid through a fluid, at a slow rate, *when no eddies are formed*, had been indicated and worked out in some important cases by Professor Stokes. It gives a resistance simply proportional to the velocity. But when the motion is so rapid as to give rise to eddies, which it always is in practical cases of water flowing through pipes and of ships, the circumstances become extremely complicated. Professor Thomson believed that the principles for obtaining practical solutions for the cases of ships were those which Mr. Napier had used in his investigation now before the Society. He concluded by saying that he had had much pleasure recently in testing, by personal experience of a voyage in the "Lancefield," some of the results of the application of these principles.

Mr. Napier said, that before commencing the construction of the "Admiral," to which Professor Rankine has referred, he applied to Professors Thomson and Rankine for advice as to the power necessary to propel vessels of any form, as his own experience led him to disbelieve the common theories based on the midship section or displacement. Professor Thomson stated then what he has now said regarding the friction of water, and Professor Rankine said, that if the resistance was the same as water in a pipe, the power required to propel his vessel at the given speed would be so many horse. The idea of water in a pipe having anything to do with the speed of a boat was strange and new to him; nevertheless, the power named was about two-thirds of what he had estimated to be necessary. A few days after making this approximation to the power, he had from Professor Rankine a formula, to which his notes supplied the data. This formula enabled him to make a vessel whose success was unprecedented.† The lines of the vessel were trochoids, with a cylindrical or prismatic middle, and as the breadth was unlimited and the draft of water limited, he made the radius of bilge equal to the draft of water, so as to have the surface a minimum. The "Athanasian" is also a trochoidal vessel, with a very short prismatic middle, and sections giving a minimum of surface. The "Lancefield" is similar to the "Athanasian," except the bow, which is a wedge, touching the trochoids at their points of contrary flexure. There are other peculiarities, however, in the "Lancefield" to which some of the economical results described by Professor Thomson may be due.

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* Read before the Glasgow Philosophical Society, by James Robert Napier.

* The Mechanics' Magazine, the *Practical Mechanics' Journal*, and the *Engineer*.

* The "Titania" or "Themis" here referred to is the "Old Titania." The yacht now called the "Titania" is a vessel of a better model.—W. J. M. R.

† See Report of Trial Trip in the *Engineer*, and Mechanics' Magazine.

Meetings for the Week.

Mon.—*Medical.*—At 8.30 p.m.
Geographical Soc.—I. "Visit to Ode, capital of the Tjebu Country, Western Africa," by Captain Bedingfield, R.N. II. "Explorations of the Elephant Mountains, in Western Africa," by Capt. R. Burton. III. "Travels in Equatorial Africa," by W. W. Reade, Esq. IV. "Notes on Madagascar," by Lieut. Oliver, R.A., at 8.30 p.m.
Tues.—*Inst. Civil Engineers.*—I. Discussion upon Mr. Hawkshaw's Paper "On the Middle Level Drainage." II. "The Charing-cross Bridge," by H. Hayter, Esq., at 8 p.m.
Royal Inst.—"On Sound," by Prof. Tyndall, at 3 p.m.
Wed.—*Soc. of Arts.*—"On the Varieties of Minerals used Economically, considered in reference to their Geological Position, and Relative Value for certain Purposes," by D. T. Ansted, Esq., at 8 p.m.
Thurs.—*Antiquaries.*—At 8.30 p.m.
Royal Inst.—"On Geology," by Prof. Ansted, at 3 p.m.
Royal Soc.—At 8.30 p.m.
Fri.—*Architectural Assoc.*—Special Business Meeting. A. W. Bloomfield, Esq., will read a Paper.
London Inst.—"On Economic Botany," by R. Bentley, Esq., at 7 p.m.
Royal Inst.—"On Japanese Art, by J. Leighton, Esq., at 8 p.m. Annual Meeting of Members, at 2 p.m.
Royal United Service Inst.—"Venetia and the Quadrilateral," by Bonamy Price, Esq., at 3 p.m.
Sat. — *Royal Inst.*—"On the Science of Language," by Prof. Max Müller, at 3 p.m.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—N. S. H.—H. B.—J. B.—T. B. and Co., Manchester (attended to).—C. W. W.—J. W.—E. C. L.—F. B.

The following have been answered by letter—J. T.—G. S.—J. V. P.—V. P.—W. R. M.—H. P.

W. H.—We would partly refer you to the answer under the initials G. C. A. There are copies of all British Patents at the Free Public Library and at the Royal Institution, Liverpool. The number of the patent you wish to see is 657, year 1862. You could procure it by forwarding 7d. in stamps to Mr. Bennet Woodcroft, Her Majesty's Patent Office, London. A rotating brush for brushing the human head is completely described and illustrated in the specification. We should not like to be the hairdresser using such a rotating brush; it would throw the *dust*, &c., about just as the water is thrown off a mop that is being "trundled."

G. C. A.—You cannot register a mechanical motion, contrivance, or principle, under the Registration of Useful Designs Act. The protection only covers the *shape* or *configuration* of useful articles. In any case such a registration costs nearly £14, and would only afford protection for three years. The only way to secure your invention would be by taking out a Provisional Protection, the Government fee for which is £5. Your invention would thus be pretty well secured for six months, which would give you time to obtain the aid of some person with money. Before, however, taking any further steps in the matter, we would advise you to carefully search whether a similar arrangement to your own has been tried before. From the short hints you give of your idea, we rather think that something similar has been attempted previously. We would advise you to look at Specification No. 1905, year 1857. We believe that this patented arrangement has been tried with some locomotive engines on the Great Northern Railway. It was unsuccessful; it racked itself to pieces. By enclosing 1s. 6d. in stamps to Mr. Bennet Woodcroft, Her Majesty's Patent Office, London, you can procure the specification. In most of the principal towns in this kingdom, however, complete printed copies of all the published specifications are on public view. You do not state your address, or otherwise we would inform you the nearest place for you to get access to the old specifications. You had better write to us again, giving your address, and we will then inform you where you can best see these old patents, as we greatly fear that you have lighted upon what is vulgarly termed "a mare's nest."

R. P. (M. S. and L. R.)—With regard to your first query, we may state that the hydrogen gas explosion theory has itself been exploded long ago. Professor Faraday, in the course of a report, made in May, 1859, to the Board of Trade, wrote, "I am of opinion that—as respects the decomposition of the steam by the heated iron of the tube, and the separation of hydrogen, no new danger is incurred. Under extreme circumstances the hydrogen which would be evolved would be very small in quantity; would not exert greater expansive force than the steam; would not with steam form an explosive mixture; would not be able to burn with explosion, and probably not at all, if it, with the steam, escaped through an aperture into the air, or even into the fire-place." Besides, steam is only decomposed by red-hot iron, when the surface is *bright*; the action ceases as soon as the oxide is formed.—2. In constructing one single apparatus for *experimental* purposes, we do not consider that you would be liable to an action for infringement.—3. Yes. For full particulars we would refer you to the Locomotives' Act of 1861. Your road engine must not emit smoke, under a penalty of 40s. for each day the nuisance is continued. The engine must be attended by two persons, and the speed must not exceed ten miles an hour on a highway, nor five miles an hour within a city, town, or village.—4. The best work on turning is that of Holtzapfel—"Turning and Mechanical Manipulation," by Charles Holtzapfel, published by Holtzapfel and Co., 64, Charing-cross. You may probably get the work second-hand from Spon and Co., Bucklersbury. The work is comprised in six volumes at present, but only three are published; each volume is complete in itself, and costs about twenty shillings. Vol. 2 would probably suit your purposes best. We would advise you to make complete drawings before beginning to make your experimental engine. The number of the specification of Hayes's steam generator is 2776, year 1861; you can get it by writing to Mr. Bennet Woodcroft, Her Majesty's Patent Office, London, enclosing one shilling in stamps.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

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OCEANIC CABLES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—In the "Journal of the Society of Arts," Feb. 6th, 1863, is a letter written by Admiral Sir Edward Belcher, which I recommend "H. K." to peruse, premising that, as I was present during the soundings referred to therein, I can vouch for the accuracy of the observation. If I had ever had any doubts, from analogical reasoning, on the occurrence of deep water currents, I should then have been satisfied. In the Hydrographical Office are stored up an immense number of such observations—similar in the evidence they give to those from which, in the States of America, Capt. Maury deduced his conclusions, and all pointing to the same great fact of oceanic currents existing above, as well as below, though more rarely below than above.

"H. K." denies the possibility of such currents. I offer him proof of their actual existence. But if, by a non-professional man, as I understand him to be, the opinion—nay, the facts—of our highest hydrographical authorities are to be treated is slightingly as those of Capt. Maury, of course, I can have nothing farther to say; but it seems to me that to disable an adversary's judgment, is a most unsatisfactory way of combating the facts on which he has formed his opinion.

Probably no sailor—certainly no hydrographer—will think of denying that there may be places and times where perfectly still water is to be found from the surface to bottom; but this is the exception which proves the rule. In the many deep-sea soundings which I have either read of, seen taken, or assisted in taking, I have never known of another instance of the line being recovered in the state of that mentioned by Capt. Dayman, though I quite understand that it would be so coiled up, under the circumstances which he describes; but on numberless occasions, after a regular descent at gradually increasing intervals, I have seen and known the line to be suddenly increased in velocity of descent by the effects of an under current. Boats, even ships, have often been carried forward at a considerable rate *against* a surface current by the expedient of sinking an iron pot or other heavy body exposing a large surface one or two hundred fathoms, so as to be acted upon by the stronger under current. This is even a common practice in certain places.

The surface current, if running constantly, or even generally, in one direction, probably causes a reciprocity of motion in the lower body of water to supply the loss. The Gut of Gibraltar is a familiar instance of this motion in a moderate depth.

The law of motion of water may be thus stated. It proceeds from the disturbed portion slowly, but surely, downwards; and as, in the case of such disturbance arising from a gale, the velocity of forward motion decreases in a geometrical ratio, from the upper strata (so to speak) which are first acted upon towards the lower, it follows that the curl or comb of the wave (the white horses, as sailors call them) is rapidly produced and increased. But where, during uncounted centuries, the trade winds have continued their action in one direction, the whole body is eventually set in motion, and the tepid water of equatorial seas flows northward in a steady current, miles deep and hundreds of miles in breadth (the Gulf-stream), to compensate for the abstraction of fluid from the Northern Ocean which must be caused by the N.E. trade.

That this is part of the great scheme of nature—that it has its objects and effects beyond what we can absolutely see or feel—has been rationally inferred from the following, among other methods of reasoning:—It seems that only such action, such interchange by currents, could be sufficient to prevent stagnation. This, if existing, would, we believe, be fatal to that wonderful development of oceanic animalcular life which plays so collectively-important a part in the formation and transformation of the globe we inhabit. It is probable that the very matter which the molluscs and animalcules build up into habitations for themselves, could only be obtained in sufficient quantity by the action of currents pervading the ocean which we suppose, nay believe, to exist. The fresh water rivers abstract from the land, and send into the sea in a state of suspension, precisely those building materials which are required by the little oceanic architects. But they are unable to go to seek them. The currents must bring them their mortar, stone, or cement. Thus we may say that the oceanic currents are the hodmen of the zoophytes who, again, are masons ever engaged in reconstructing the earth.

Are these views too strongly, too fancifully, expressed? Look at the shell deposits of the earth—examine the chalk hills which were once the ocean bed. It is not too much to affirm that to corallines do we owe a considerable proportion of the habitable earth—a proportion which is always on the increase. It is not fancy which places those globigerinæ in the microscopic field—identically alike, whether derived from the chalk of our inland counties or the deep-sea soundings of the Atlantic. I have, perhaps, digressed from my subject; but such are the probabilities of currents and also of the nature of the bottom—both which subjects imperatively demand careful investigation from those who would devise or theorize upon oceanic cables. From such facts we deduce the inference that the bottom of the ocean generally is uniform, soft, and undisturbed.

The opinion of two physicians is generally regarded as conclusive on a diseased frame; but I see that "H. K." is not disposed to admit that two sea-doctors are equally entitled to respect, so I must give a few more of the hundred reasons to which "Old Sailor" happily alludes. I thought, I confess, that when it had been shown that a plan for laying cables near the surface failed in doing more than supporting it at some few points, the idea would be given up.

But "H. K." has shifted his anchorage to the north, and, I suppose, I must follow him thither.

I think it will strike most people as extraordinary, to say the least of it, that a gentleman who firmly believes, and satisfactorily (to himself) proves, that there are no such things as deep-sea currents, admitting at the same time the existence of surface currents, should leave the tranquil depths below and take his cable into the troubled waters above. "Old Sailor" has shown him "why" I was afraid chain or wire would not support its own weight, including barnacles and other attachments, therefore little more need be said on that head. But I also would like to know whether "H. K." thinks it an advantage to encounter the chances of a few thousand icebergs every year; for as some of these float with a proportion of 150 fathoms below to 159 ft. above (See Sir J. Ross's evidence in the Blue Book on Submarine Cables), it is evident that they would be very likely to come across one of his buoys, and tear away buoy, cable, and all. But if I were to adduce the many reasons which occur to any seaman, or even to any telegraph engineer, against such ideas as "H. K." advocates, I should waste your space, tire your readers, and, as far as I am concerned, get thoroughly weary of the argument. I hope icebergs, barnacles, and catenarian strain may prove to be objections tangible enough, if not for "H. K." yet at least for others. I therefore must beg him to excuse my further notice of a proposition which is tenable in no single point of view, so far as I am a judge of its merits.

And now I will devote the remainder of my letter to the pointing out what is, in my opinion, really desirable as regards deep-sea cables. Of the ocean bottom we know amply enough to prove that cables once laid there are likely to be and remain undisturbed, except in volcanic regions, which may be and ought to be avoided. Therefore the problem resolves itself into a consideration of the best means of getting them to the bottom with the greatest rapidity and the least danger. "With the greatest rapidity" means that a quick sinking-cable must be sought and employed. "With the least danger," on the other hand, means that a strong cable—strong relatively—must be secured. Unfortunately, these two are antagonistic. Mr. Duncan's rattan cable is *not* strong relatively to its bulk, though it *is* strong relatively to its weight in water per mile; and the bulk, as it governs this latter quality also governs the rate of sinking, makes it sink slowly. Now this is the very worst quality a cable can have, for it remains longer in danger the longer it is in getting to the bottom.

We accept, it is true, as a necessity, a certain diminution of specific gravity; for without it, the cable would not bear its own weight; but at the same time it is also true that, if we could have the qualities we should most prefer, they would be as follows:—the maximum of strength, the minimum of bulk, and the greatest rapidity of sinking. I hope I may succeed in saving some, who have, I fear, misunderstood the problem, from spending any more time or money over schemes for slow-sinking or floating cables. If any one wanted a floating cable—if telegraphists of any experience, and seamen with any knowledge of this part of their profession did not abhor the very idea—it would be the easiest thing in the world to secure a floating cable with merely a sufficient mixture of manilla hemp; but this is just what we do *not* want—this would increase, not diminish, our dangers and difficulties. Of all the cables which I have yet seen or heard of, Mr. Allan's is the one which most nearly fulfils the mechanical conditions sought for; and, I believe, there are few electricians now who can honestly find fault with its fulfilment of the electrical conditions to be desired. Were it true even, that something in this direction has been sacrificed, the gain in other ways would more than compensate for the loss. I say this as a perfectly unprejudiced observer; for I have no other interest than a scientific one in Mr. Allan's system; but I see that it gives the greatest strength in the least bulk, with rapidity of sinking as a consequence, and that, without any outer plastering, the strength is, and is likely to remain, protected from decay. As for the system of laying which I have long advocated, and which has secured the support of my profession, among whom I reckon men experienced in cable laying—which I may say also, is approved by not a few electricians and engineers—it is equally applicable to any and every description of cable, and therefore it cannot be said that I advocate any special rope; but when it is absolutely certain that the cost of the gutta-percha-covered conducting-wire alone, would, for an Atlantic cable, more than absorb the whole sum hitherto subscribed for the renewed attempt to connect England with America—when we know that £300 per mile for a cable has been not only proposed but entertained as a rational expenditure for so great a purpose—it is a duty which every one owes to the advancement of science to urge, by every means in his power, the method by which the outlay may be brought within more manageable limits; to consider, in every stage of the operations necessary to establish telegraphic submarine communication, how money may be saved, how danger may be eliminated or diminished. It is not necessary to lay expensive cables, if only they be properly treated. It is not by overweening self-confidence that dangers are most likely to be successfully met or combated. We are now, it appears, going to have another great experiment in the Persian Gulf cable. Nine hundred miles of a cable weighing about four tons to the mile, and of an inch and a quarter in diameter, are to be taken in sailing vessels round the Cape of Good Hope, to be deposited in water varying from 30 to 800 fathoms. It is true it can scarcely be considered a deep-sea cable; for, rather than encounter the dangers of the ocean, our land engineers prefer to trust to the tender mercies of the Arabs and the attachment of the corallines, &c.; but I could scarce believe my ears when, after all that has been said in the Blue Book and elsewhere about light cables, I found that we were to lay a cable four times as heavy as the late Atlantic, and also were to lay it out of sailing vessels towed by steamers. At what expense it will be done, may be judged by the fact that the Malta and Alexandria Cable cost, from first to last, nearly a quarter of a million sterling for the ships which carried it alone—the cost of cable making up the rest of a sum of £750,000, which I hope represents the total, on which I have heard 39 per cent. is the gross profit during the past year. I cannot but regret that the working of this cable and all the expenses or receipts connected with it, have not been placed by the Government at the disposal of the telegraphists in particular, and the public in general. Paying as the public do for the mismanagement of the Red Sea Cable, I think the nation, and not any eminent contractors, have the first right to any information about a cable made from national resources.

J. H. Selwyn, Capt. R.N.

INDICATORS AND BOILERS.

Sir,—I have read with much interest the review on the work on the Indicator, in the Mechanics' Magazine, and would wish to make a few remarks on certain portions of it:—

First, I entirely agree with you as to the desirability of thoroughly warming the indicator before using it to trace the atmospheric line, and this is certainly very needful in the case of the ordinary indicators, in which there is such a large mass of metal for the heat to act on, and which, therefore, takes some considerable time to get expanded. Secondly, you state that you "differ with the author" in regard to "great economy having been effected in locomotives by the use of expansion." Now, here I think you are in error, as there cannot be the least doubt as to the great economy obtained by the use of the link in locomotives, in place of the old "gab" arrangement, by which means expansion can be employed, and from that moment coal consumption per mile was reduced nearly 50 per cent., and I think it will generally be admitted that, for their power, locomotives are the most economical engines at work.

I agree with you that a "very large field in that direction is still unexplored by railway engineers;" and it is true that none of the indicators you name can take a card that can be "implicitly relied on." It will, I doubt not, be a satisfaction to all who look for a really true, good, simple, and correct indicator, to learn that such a one has at last been produced, and is now in course of manufacture. It has been tested on high pressure engines with 55 lb. steam making up to 220 revolutions per minute, and it produces most perfect and steady cards which can be implicitly relied on. We are now trying it on a locomotive working express trains up to 55 miles per hour, with steam up to 130 lb., and it works admirably. It seems to me that it cannot fail to give perfectly correct indications at any practicable speed, and when tried in slow speed engines, shows inaccuracies which none of the other indicators reveal.

This is the Richards's Indicator, introduced and patented by Charles T. Porter, and was used by Mr. D. K. Clark for taking the diagrams from the engines at work in the International Exhibition. The remarks quoted on the desirability of frequently using the indicator on all engines are excellent, and also those relating to the "engineer" and "engineman." It is a disgraceful fact that "price" is preferred to "quality" in this respect, and that too, in a question where economy in *pence* can hardly fail to lead to extravagance in *pounds*, which will not, I think, be called a very "business way of doing it." On the Continent all men in charge of engines have to pass an examination to to prove their fitness.

The Gateshead engine-maker is not alone in his ideas as to vacuum, as I have heard of a similar occurrence on a well-known river "over the border," and there are instances where 31 in. of steady vacuum have been claimed!

The remarks as to the inadvisability of the huge exploders called boilers I fully agree with, especially as quality of material, right proportions, careful manufacture, careful use, and good attendance and treatment, are not always to be obtained where they are used.

In regard to the employment of steel for boilers of large size, I am not quite convinced of its superiority to good iron of known reputation, as it would seem that the exposure to high temperature which boilers of all kinds experience, must tend to decarbonize the steel, and this most particularly in those boilers most subject to incrustation, and least carefully attended; therefore, if a light boiler has been made of steel, to carry high steam (higher than the same thickness in iron), and this process goes on, it is a question how long that boiler could be considered safe, and whether there would be the great advantage in using steel, which its superior power of resisting strains, if not otherwise exposed to disadvantage, would lead us to hope for.

Löwe found that "wrought iron long exposed at a red heat to steam, became crystalline, and that even the heat alone produced this effect, without the application of moisture. It is not easy to find the cause of this phenomenon in any chemical property of iron; but, be it what it may, the fact is undoubted that iron long exposed to the action of fire loses its fibrous texture, and becomes brittle and crystalline, and results in a weakening of the tenacity and cohesive force of the metal."

With respect to the remark that there is no governor exact enough for regulating cotton mills, I think the beautiful sensitive governor patented by Silver, and in which, if the speed varies over *one-sixth* or less of the revolution of the engine, it is instantly corrected—and also that patented by Charles T. Porter—must have been overlooked, as it seems to me that they are eminently adapted for the purpose.

Of the desirability of a hard cast iron for cylinders, there can be little doubt, but this is now seldom considered by either buyer or seller in those cases where price is the "governor," which, I may say, is the case always, especially since the market has become flooded with "cheap" engines, and purchasers act on their own responsibility, preferring to buy ready-made, instead of employing an engineer to see things done in a proper manner. As to beam and horizontal engines, the superior patronage bestowed on the latter sufficiently shows the predilection to be superior for its employment, but a badly-made horizontal engine may be worse than an equally badly-made beam engine.

The injector, as at present employed, is neither an economical nor a reliable substitute for a pump. I have seen it stop working with cold feed, and refuse to work with feed at 90 deg., as tried with a thermometer; and where a good feed heater is used, the employment of an injector to work with cold feed may be taken as a loss of from to 5 to 10 per cent. in the working of the engine—a disadvantage which I think cannot be easily overcome.

You remark, "there is *always* a dome" on locomotives; this is only partly correct, inasmuch as all the new engines on the Great Western, and many other lines, have *no* dome, but the steam pipe is perforated with small holes or narrow slots on its upper side for the passage of the steam, and is carried under the top of the boiler to the breeches pipe in the smoke box.

As to the injury done to the metal by the present unscientific manner of punching the rivet holes, and then "drifting" them up when they do not match, there can be no doubt; it is a disgrace to our "practical" men that such a state of things should exist, especially as there can be no difficulty in arranging a machine to drill the holes, and the greater part of the plates in a boiler, in such a manner, as to allow of the greater part of the plates being drilled at once, and so that the holes must come "dead true" to one another. I have seen in a factory in the North a 7 ft. boiler of ⅜ plate in course of construction, where the holes were barely one half open, through possibly one-tenth of their number, and after some chipping and drifting, the rivets inserted, or I should rather say "jammed" in and rivetted over, and each, when "snapped," look a real "Simon Pure!" Certainly, there is great room for improvement here.

Warming the plates before bending, to form the shell of a boiler, is certainly advisable; but dished and other plates would, of course, have to be heated. I believe the plates for the Victoria Bridge, at Montreal, had the holes drilled, and so exact was the work, that a rod might be dropped through a hole in a pile of a dozen or two of plates and pass through each. Where boiler making is a business, it would surely be worth while to ensure the greatest exactness by some such method as I have before hinted at.

Your obedient,

Chas. F. T. Young, C.E.

7, Duke-street, Adelphi, W.C.
April 18, 1863.

Miscellanea.

At the special meeting of the Submarine Telegraph Company it was stated that the business was satisfactorily increasing, and that all the liabilities would be discharged, and a substantial reserve established for the proposed allotment of stock. A dividend at the rate of 4 per cent. per annum was declared; and additional capital agreed to be raised in the manner recommended by the directors.

Foreign journals speak of an invention just produced in Germany—namely, a musical bed, so constructed that, by means of concealed piece of mechanism, the pressure of the body produces the softest harmony, which lasts long enough to lull one to sleep. At the head of the bed is a dial with a hand, which can be placed at whatever hour the person wishes to awake; and at the time fixed the bed plays a march of Spontini, with drums and cymbals, loud enough to wake the soundest sleeper.

The quantity of caoutchouc (india-rubber), in its raw or unmanufactured state, imported into the United Kingdom in 1861, was 57,834 cwts., the value of which was £435,923. Of this quantity, Brazil sends 29,042 cwts.; British India, 14,050 cwts.; United States, 9,251 cwts.; New Granada, 1,202 cwts.; Fernando Po, 1,000 cwts.; and all other countries, 3,283 cwts. The price of this commodity varies from £8 5s. 2d. to £3 8s. 1d. per cwt. Of caoutchouc in its manufactured state, the chief items are overshoes and boots, which show a total of 743,535 lb., valued at £41,311—the price ranging from 1s. to 1s. 6d. per lb. Of that quantity Hamburg contributed 289,079 lb.; Hanover, 291,589 lb.; France, 119,328 lb.; United States, 14,208 lb.; British North America, 15,629 lb.; and all other parts, 4,702 lb. Of other descriptions of this manufacture the quantity imported was 116,611 lb., valued at £12,441, the principal portion whereof came from Hamburg, Belgium, France, and the United States.

It is asserted that the largest carriage manufactory in the world is that of a Berlin company formed for the supply of railways. Last year it is said to have employed 1,552 men, and to have made sales to the omount of 1,815,489 thalers (about £270,000).

"J. W." in a letter says:—"It is very amusing to read the recommendations of our great men, particularly when they lay claims to plans which have been published months before in your magazine. Mr. Fairbairn recommends a belt all round the vessel to protect the hull. Well, you have made that plain by drawings long ago, so that your readers will see that he does not deserve great credit for the idea. Sir Edward Belcher mentions another plan on the same page; he, too, adopts it for his own.

Water-glass in Soap.—In the last number of *Silliman's Journal*, Mr. J. M. Ordway, who has devoted much attention to the composition and application of alkaline silicates, states that a mild silicate (water-glass) is now manufactured in Boston and New York, and has come into very general use among soap-makers. It is used as a substitute for rosin, which had been largely employed in the manufacture of soap, before the blockade of the Southern ports. It materially reduces the cost of soap, and imparts neither colour nor smell to it. About 60 per cent. of the fluid silicate, it is stated, may be mixed with the common materials that are employed for making bar soap. Mr. Ordway says:—"It is certainly quite safe to incorporate twenty five or thirty pounds of liquid water-glass with one hundred pounds of pure oleo-stearate of soda. The compound thus produced has greater detersive power than common soap."

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2657, 2658, 2662, 2678.
Boilers and Furnaces, 2626, 2668.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2622, 2630, 2642, 2647, 2666.
Ships and Boats, including their fittings, 2611, 2638, 2652, 2663.
Cultivation of the Soil, including agricultural implements and machines, 2614, 2639, 2646, 2669.
Food and Beverages, including apparatus for preparing food for men and animals, 2627.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2616, 2623, 2628, 2632, 2636, 2637, 2650, 2651, 2660, 2665.
Buildings and Building Materials, 2625, 2629, 2644, 2645, 2670, 2676, 2677.
Lighting, Heating, and Ventilating, 2615, 2658, 2664, 2671.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2612, 2617, 2618, 2620, 2621, 2648, 2653, 2661, 2673.
Metals, including apparatus for their manufacture, 2641.
Chemistry and Photography, 2667.
Electrical Apparatus, 2619, 2675.
Warfare, 2624, 2640, 2649, 2679.
Letter-Press Printing, 2654.
Miscellaneous, 2613, 2631, 2633, 2634, 2635, 2643, 2655. 2659, 2674.

2611. R. Alexander. *Improvements in mariners' compasses.* Dated September 25, 1862.

This invention has for its object the improvement of the mariners' compass, and the parts in connection therewith. The improvements consist of an apparatus so arranged as to counteract the effect of local attraction of the iron or other metals upon the needle of a compass in a ship, a vessel, or other place where the magnetic needle is used, thereby enabling it to obey the terrestrial magnetic influence only; and in the use of alumina iron, iron alloyed with nickel, or other ironide for magnetic compass cards; and also in the use of iron alone or alloyed, for the bowls, runs, hoods, and binnacles of mariners' compasses. *Patent abandoned.*

2612. M. A. F. Mennons. *Improvements in the construction of chair settees.* (A communication.) Dated September 25, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2613. T. Kennedy. *Improvements in taps or valves.* September 25, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2614. F. Tolhausen. *An improved steam cultivator.* (A communication.) Dated September 25, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2615. J. Raywood. *Certain improvements in the construction of gas apparatus for the prevention of fraud, and for economizing the consumption of gas.* Dated September 25, 1862.

This invention consists in directing and regulating the supply of gas to the burner, and the patentee proposes to accomplish the same in the following manner:—Enclosed in an outer casing of any suitable form or dimensions, and of any suitable material, he inserts one or more perforated tubes of zinc, or other material, or of wire gauze or netting, in which he places a solid plate or diaphragm at a proper distance from the bottom of the casting, so that, when the gas comes in contact with or against the under side of the plate, it is forced through the apertures of the perforated tube immediately below the plate into the outer case or socket, and it has then to re-enter or pass through the perforations of the tube above the plate before it gets to the burner or tap, thus breaking the rush of force, but not diminishing the supply, and producing a steady and a better light, and preventing the noise and waste of overdue pressure. *Patent completed.*

2616. J. R. Breach and E. B. Pye Smith. *An improved machine for reducing or equalizing the length of animal or vegetable fibres.* Dated September 25, 1862.

This machine consists principally of the following parts—1, an endless travelling cloth or apron upon which the fibres to be operated on are placed. This cloth or apron carries the fibres forward, and delivers them on to rollers, discs, or wheels made of metal, wood, or other suitable material, over which are placed other rollers or wheels held down by means of springs or weights, so as to compress and hold the fibres. These rollers or wheels are actuated by suitable gearing, so as to advance the mass of fibres, and present them continuously to the edges of circular saws, breakers, or tearers, one of which revolves between each pair of rollers or wheels. These saws or breakers are formed with projections so constructed as to break or tear the fibres asunder (without cutting them), which then fall down into a receptacle beneath. The wheels or rollers, and also the saws or breakers, are placed at suitable distances apart, according to the length of fibre desired, and are capable of being adjusted near to or further from each other, so as to produce fibres of the exact length required. *Patent completed.*

2617. J. Eardley. *Improvements in pitch pipes or tuning pipes.* Dated September 25, 1862.

This invention consists in constructing pitch pipes or tuning pipes by inserting in the usual tube, or the outer case of the same, a sliding or moveable piece or frame, which contains the sounding reed or tongue, so that, when necessary, the same may be removed to clear the reed of dirt or obstructions. At or near the fixed end of this reed or tongue, the patentee places a sliding or shifting piece, termed the regulator, which can be moved to and fro so as to nip or hold the reed or tongue at various points, and thus increase or diminish the length of the free part of the said reed or tongue, and, by the use of scale marks, ensure the production of the note or tone required to be sounded; hence these pitch or tuning pipes can be made to sound any and every one of the notes of the chromatic scale, whether full tones or semi-tones. *Patent completed.*

2618. W. Lea. *Improvements in hinges for French casements.* Dated September 25, 1862.

This invention is described and illustrated at page 252, No. 223 of the present volume of this journal. *Patent completed.*

2619. A. Potter. *Improvements in electro-magnetic engines.* Dated September 25, 1862.

This relates to the means of obtaining electro-magnetic motive power by direct rotary motion, and the engine consists of a fixed circle or band of soft iron bars screwed straight across the inside edges of two or more stout wheels; the widths of these bars are to correspond with the thickness of the covers of the electro-magnets to be used. The distance between each bar is to be double that of the width of the bars themselves, and the number of bars to be used in the circumference of the wheels may vary according to the measurement of the circumference, which measurement must be equally divided by the thick of the cores of the electro-magnets. The axle or shaft of the engine is to be set in bearings supported by standards from the foundation plate, and its centre will be also the centre of the circle bars which form armatures for the electro-magnets attached in radial lines to the centre shaft. The length of the armatures may be varied, so as to allow of several electro-magnets being attached to the shaft, side by side, in the same radial line, and form an engine of greater breadth. There should be three, six, or any multiple of three electro-magnets fixed on the axle, that is to say, such number of radial magnets, although such radius or series may consist, as before stated, of one or more than one magnet on the axle, each in the same plane, and they are to be of such length as to rotate as close as possible to the armatures, but without actual contact. The invention relates also to a break for connecting and disconnecting the electric current. *Patent abandoned.*

2620. P. Wright. *Improvementsin the manufacture of parallel vices.* Dated September 25, 1862.

Here the patentee first constructs a slide-box or receptacle for the slide to work in; this may be made of either wrought or cast iron, and receives a slide-bar, the section of which is similar to that of a piece of T-iron. He then forges or stamps out the two parts intended to form the jaws, one of which is fixed securely on the slide-box, and remains stationary upon it; this jaw is slotted in its lower parts to allow the slide-bar to pass through it; the other jaw is also similarly slotted, but is bolted on to the end of the slide-bar. The grip may be obtained by means of a box and pin in the ordinary way; or the stationary jaw may receive a female screw through which the pin or male screw may work, a collar being fixed on the pin to bring back the moveable jaw. By these means the patentee obtains a perfectly parallel motion with a firm grip. *Patent completed.*

2621. J. R. C. Taunton. *Improvements in the manufacture of metallic bedsteads, cots, and couches.* Dated September 25, 1862.

This consists in making the foot rails with a graceful sweep, curve, or other ornamental line in plan. This the inventor effects by curving or shaping the angle iron or bar forming the frame at the foot into any desired shape; and if he requires to use a solid foot rail upon this frame, it may be made of sheet metal japanned, if requisite, and afterwards ornamented by attaching thereto planted or raised enrichments in various descriptions of metal, papier mache, wood, composition, or other suitable material. *Patent abandoned.*

2622. E. G. Muntz. *An improvement or improvements in the manufacture of axles.* Dated September 25, 1862.

This consists in employing cast and wrought iron or steel in combination in the manufacture of axles. The inventor takes for the arm or centre of the axle a bar or faggot of wrought iron or steel, around which he casts iron or steel. *Patent abandoned.*

2623. T. R. Harding. *Improvements in machinery for opening, cleansing, and carding fibrous materials.* Dated September 25, 1862.

This relates—1, to apparatus for opening, cleansing, or preparing fibrous materials. The material is placed upon a travelling feeding sheet, which delivers it to the first of a series of porcupine rollers. Each of these rollers has its pins set in a direction contrary to that of its motion, and an increased speed is given to each of the rollers of this series of the roller immediately preceding it. Thus, the second roller on to which the material passes has an increased rapidity of revolution as compared with the first roller. In like manner, the third revolves more rapidly than the second: and so on through the series. Under each of these rollers (which may be heated) is a dish, trough, or plate of the same sweep or curve as the curve described by the points of the pins during the revolution of the rollers. The inner surface of the dish, trough, or plate approaches nearly to the points of the pins, but openings may be made in various parts of the dish, trough, or plate so as to allow any waste tow, or any impurities or foreign matter to fall through. Between each porcupine roller the plates, dishes, or troughs are joined, and when the material is taken from one roller to the other, it is drawn out a little by the greater speed of the roller which takes it up. The fibrous material is then taken from the last roller by any of the ordinary mechanical arrangements now in use for the purpose. The invention consists—2, in a mode of constructing circular card cylinders, whereby they can be made lighter and at less cost than those now in use, and so that the dust and other impurities may be removed from the fibres with facility. *Patent completed.*

2624. W. Pettet. *An improved covering for protecting vessels and forts from shot, shell, and other warlike missiles.* (Partly a communication.) Dated September 25, 1862.

This consists in covering the exposed parts of the structure to be protected with an armour composed of boiler-plate iron and an intermediary elastic filling. *Patent abandoned.*

2625. J. J. Bates. *A new or improved window sash fastener or guard.* Dated September 25, 1862.

This consists in so arranging certain levers and springs in connection with plates of metal having holes therein that a window sash, when shut down, may with facility be fastened, and when partly open, may be retained in that position, and prevented from being raised from without. *Patent completed.*

2626. E. Dixon. *Improvements in machinery and furnaces used in the manufacture of welded iron tubes.* Dated September 26, 1862.

This relates to the simultaneous welding of two tubes; and the distinctive features of this invention are the use of a single or ordinary draw-bench, instead of a double or compound draw-bench, and the building of the furnaces separately or wholly independent of each other. *Patent completed.*

2627. C. D. Abel. *An new or improved purifying or preservative lotion for the mouth.* (A communication.) Dated September 26, 1862.

Here the inventor mixes together one ounce of the following ingredients:—Cochlearia, vine tendrils, rose leaves, pyrethrum, pounded Peruvian bark, earth moss, and scraped horse-radish; to these he adds thirty-two ounces of alcohol of 18 deg. strength, and thirty-two ounces of distilled water. This mixture is then allowed to stand for about a fortnight in a warm place. At the end of this time he adds one ounce of the root of anatherum and one ounce of pounded cloves, and again lets it stand for another fortnight or three weeks, shaking it frequently during that time. The fluid portion of the mixture is then separated by filtration, and to this is added two ounces of tincture of myrrh, two ounces of tincture of guajaci, and two ounces of tincture of cinnamon. The lotion is then bottled for use. *Patent completed.*

2628. J. Milner, R. D. Milner, and F. Hurd. *Preparing fibrous substances.* Dated September 26, 1862.

This consists in regulating the drag in the passing of the sliver of wool or other material from the front drawing roller to the bobbin by means of friction discs, in substitution for the apparatus ordinarily employed for that purpose. *Patent completed.*

2629. W. E. Gedge. *Improvements in the construction of leaden window sashes, casements, or glazed coverings or partitions.* (A communication.) Dated September 26, 1862.

This consists in forming in the leaden sashes small holes or openings for carrying off the condensed vapour which forms on the inside of the glass. *Patent completed.*

2630. W. M. Cochrane. *Improvements in securing the bolts and nuts of railway fish plates.* Dated September 26, 1862.

Here the inventor retains the screw nuts—and also the screw bolts when they are not otherwise held from turning—by employing plates of thin metal between the fish plates and the screw nuts, and also between the fish plates and the heads of the screw bolts, when the screw bolts are not otherwise prevented from turning. These thin plates have two holes through them to admit of the two screw bolts near the end of a fish plate passing through them. The thin plate is of sufficient length to extend beyond the two screw nuts which fasten one end of a fish plate to a railway bar, so that when the screw nuts have been screwed tightly, the ends or the angles of the thin plate are turned away from, and at right angles to, the fish plate, so as to come against one or more sides of each of the screw nuts, by which the nuts will be securely held and retained from turning after being once well screwed up. In like manner a similar plate is placed between the two heads of the two screw bolts, which are used to fasten one end of a fish plate to a rail when such screw bolts are not otherwise prevented from turning. *Patent abandoned.*

2631. F. R. Stack. *Improvements in escalading apparatus for military purposes.* Dated September 27, 1862.

This invention consists of a platform of splayed timbers, mounted at one end upon travelling wheels, behind which there is a guiding lever with stay irons jointed to the platform. Upon the timbers is placed a series of planks or treads at a short distance from each other, for crossing moats or ditches (the inner side of which is not much higher than the outer one); the apparatus is thrown across intact. But for scaling walls, which require the apparatus to be elevated to an angle of more than about 30 deg., every alternate tread is removed so as to form a ladder. For passing over low walls or pales, two platforms are jointed to a central piece, the whole being kept straight by ropes passing over stanchions. After being placed in position, the ropes are cast off, when the central piece takes a bearing upon the top of the wall or stockade, and the inclined platforms afford the means of ascending on the one side and descending on the other. *Patent abandoned.*

2632. J. Crosby. *Improvements in carding engines.* Dated September 27, 1862.

This invention consists in an improved arrangement for removing the impurities from the fibrous materials during the process of carding. Under each working roller the inventor places a sheet of metal, or other suitable material, in such manner that it receives and conveys the impurities which are thrown off to the floor or other desired place or receptacle. *Patent abandoned.*

2633. H. Hutchinson. *Improvements in machinery for covering wire with india rubber and gutta percha, and similar gums and compounds thereof, and for manufacturing tubes and other articles of such gums and compounds.* (A communication.) Dated September 27, 1862.

The main object of these improvements is to effect the covering of wire of any length with india rubber and gutta percha, and their allied gums or compounds thereof, and the manufacture of tubing of any length of such gums or compounds by an uninterrupted operation. The principal portion of the machinery to which the improvements relate consists of a screw working in the bore of a cylinder, into which the gum is fed, and from which it is forced by the screw through or into a die of the necessary size and form to produce the exterior of the covering tube or other article to be produced. *Patent completed.*

2634. M. Henry. *Certain new and improved applications of petroleum and its products, certain agents produced by combining the same with other substances, and certain modes of treating caoutchouc, gutta percha, and their compounds, and substances similar thereto.* (A communication.) Dated September 27, 1862.

This invention relates to the employment of petroleum and its products for vulcanizing and devulcanizing caoutchouc for producing certain agents or compositions, and for other manufacturing and useful purposes. In carrying out the invention, a particular product or mixture of petroleum (called mixed petroleum) may mostly be employed with advantage. This product or mixture consists of a combination of the three following products, obtained by distillation or rectification from the clear and very volatile petroleum generally procured from America, though it may be from other places: -1, a clear colourless liquid, boiling at about 154 deg., smelling like ether, and of the density of 0·669 deg. At 60 deg. the density of its vapour is 3·05 deg. This liquid, which is the most plentiful product of distillation, is called (especially by Pelhouze and Cahours) hyduret of Caproylene. 2, a clear, colourless, strongly-smelling etherated liquid, distilling at about 203 deg. 3, a heavier, clear, colourless liquid, distilling at about 310 deg. By combining these three products, the compound which is called mixed petroleum is obtained. A principal object of the invention consists in the application of petroleum as a solvent. *Patent completed.*

2635. J. C. P. Bauchard. *A twice-transversal kneading trough.* Dated September 29, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2636. H. Brum. *Improvements in the manufacture of moreens and such-like fabrics.* Dated September 29, 1862.

The object of these improvements is economy of manufacture by the introduction of jute yarn therein, as a substitute for worsted yarn, for the weft in the manufacture of such fabrics. *Patent abandoned.*

2637. J. Brown. *Certain improvements in carding engines employed for carding cotton and other fibrous substances.* Dated September 29, 1862.

This invention relates to that portion of the carding engine known as the doffer, a principle feature therein being the ready adjustment of the doffing comb or knife. The improvement consists in the novel method of imparting an adjustable rocking motion to the shaft to which the doffing comb is secured, which is effected as follows:—A slotted tail piece or quadrant is keyed upon the rocking shaft, and is connected by means of a connecting rod with an eccentric or crank driven by band and pulley, or other means, the connection with the slotted quadrant being effected by screw and nut rack and pinion, or other equivalent means, by which the position of the connecting rod may be adjusted in the slot of the tail piece or quadrant, so as to lengthen or shorten the curvilinear motion or course thus given to the doffer as required. *Patent completed.*

2638. R. Griffiths. *Improvements in the construction of iron ships and in the method of fastening metal sheathing thereon to keep them from fouling.* Dated September 29, 1862.

This invention consists in having slips or bars of iron or other suitable metal secured with screws or rivets along the longitudinal joints of iron ships, having rabbets or recesses on each edge of them, so that strips of wood or other suitable material can be inserted so as to caulk and secure the joints, and keep the water from coming in contact with the joints and rivets, or passing through the joint in the skin of the ship. When the ship is built with one row of plates lapping over the other, or what is generally termed "clinker-built," the ships or bars in that case will only require to have the rabbets or reccases on one edge, the recess on the other edge being formed by the bars being placed as much over the edge of the plate as will be required for the wood or other caulking material to be inserted. When the iron ship is to be sheathed with metal sheathing, the patentee coats over those parts which are to be sheathed with marine glue, or other suitable adhesive material that is a non-conductor of electricity, and also the metal sheathing, which may be sponged over with an ordinary suitable solution such as is used for marine glue; or the sheets of sheathing may be made hot (to make them and the non-conducting materials stick together) just before the sheathing is put on; it (the sheathing) is then nailed along its edges to the wood or the material that is in the rabbets or recesses of the iron strips along the joints of the ship. When the iron plates in the skin of the ship are wider than it would be desirable to have the sheathing sheets, he then puts longitudinal strips of iron with a recess on each edge of them for inserting the wood in along the middle of such plates to secure the sheathing to. When the sheathing is secured to the strips of wood that are in the recesses of, or formed by the iron strips or bars, he then covers the strips or bars with sheathing metal nailed to the wood strips along the edges; or the longitudinal strips or bars may be covered with a thicker metal than the sheathing, so as to clip the edges of the sheathing sheets, and secure the wood strips in the recesses of the longitudinal bars. The strips of covering metal he proposes to secure to the wood strips by metal screws, so that they can be readily removed when the sheathing is to be replaced. In such iron ships where it is not necessary to caulk the joints, as already stated, he puts longitudinal narrow cleats of wood, at suitable distances, to which he nails the sheathing in a similar way to that described when iron strips with wood inserted on each side are used. *Patent completed.*

2639. M. Puddefoot. *Improvements in apparatus for tilling land.* Dated September 29, 1862.

This invention consists of a truncated cone forming the body of the instrument; this is mounted on an axis and in a suitable frame, so as to turn in a rolling direction while passing over the ground. The frame is furnished with handles to guide it like an ordinary plough, and a beam or part to apply the tractive force. On the cone piece or body at the large end, the inventor applies in radial positions what he terms curved coulters or tines, sharp on the one edge, and thick on the other edge or back, and on the other end he mounts, in a similar and radial position, a series of what he terms shares, being spade-like instruments which are set at an angle to the axis, and so as in revolving to throw the soil on one side, that is, in the direction of the length of the axis, so as to form a furrow. This implement, in rolling over the ground, causes the tines or coulters to enter and stir up the soil, while at the same time the spades or shares forms the furrows. The tines or spades act on different parts of the soil at the same time, the tines during the one traverse of the implement loosening and lightening the soil operated on in the subsequent traverse of the spades. *Patent abandoned.*

2640. W. B. Lord. *Improvements in loading firearms, and in blasting.* Dated September 29, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2641. W. E. Gedge. *An improved furnace for casting steel.* (A communication.) Dated September 29, 1862.

This improved furnace (which is more especially intended to cast steel in large masses) is composed of a crucible or basin of reception, with a moveable cover or lid at its upper part, and at its lower part an opening, called the tapping-hole, of a fire-place beneath the crucible, with doors, grating, and ash-pit or pan. On issuing from the fire-place the flames embrace all parts of the crucible, and gain the chimney-piece above. A little above the crucible is an opening for inspecting the working, and at the bottom of the fire-place are conduits or blast pipes for increasing the draught. The ash-pit, the fire-place, the crucible, and part of the chimney are surrounded by refractory brickworks, which are in their turn enveloped in the ordinary brickwork which forms the exterior of the furnace. *Patent abandoned.*

2642. J. E. Walker. *Improvements in signalling on railways.* Dated September 29, 1862.

This invention consists in, or has reference to, signalling from a station or other place on the line of railway by sounding a whistle or alarum (or a bell) attached to the engine, or other point of the train, if desired, and for which the inventor prefers to use the following arrangements:—He places a post or standard at the side of the railway, and sufficiently near to the rail for the purpose hereafter mentioned, the said post being provided with a moveable bar, arm, lever, or projecting piece attached thereto, to which is connected a wire, chain, or cord passing over pulleys, and carried to a station or point where a railway attendant can, by actuating the same, move the said moveable bar, arm, lever, or projecting piece when required to signal, and whereby the same may be brought back again against the post or standard when the position at rest is required simply by the attendant adopting a reverse movement. The said bar, arm, lever, or projecting piece is to be so much elevated above the height of the rail that it shall be in a position to lift or act upon a moving bar, arm, lever, catch, or projecting piece attached to the front of the engine, or to other point in the train of carriages, and by such lifting or acting upon the said bar, arm, lever, catch, or projecting piece will thus act upon arrangements consisting of a chain, wire, or cord passing over pulleys and connected at its other end to the handle or tap of the steam whistle. Or these arrangements would set a-going the alarum or bell, and sound the same when connected with such arrangements. *Patent abandoned.*

2643. H. Hirsch. *Improvements in apparatus for showing combinations of colours.* Dated September 29, 1862.

This invention relates to the production of combinations of colours by giving coloured surfaces rapid rotation, and consists—1, in a mode of producing the rotation for this purpose by the employment of certain twisted strings (as described); 2, in a mode of causing the rotation of discs or other figures with various colours, patterns, or perforations to be retarded, and accompanied by vibratory motion, by means of portions turned up so as to be resisted by the air (as described). *Patent completed.*

2644. H. Moule. *Heating frames and the beds of hot-houses.* Dated September 29, 1862.

In order to heat the beds of frames and hot-houses in which pots containing plants are placed, or which contain the earth in which the plants are growing, or where moist heat is required for other purposes, the inventor forms below the bottom of the bed a chamber kept constantly or as often as required supplied with steam; the steam is intro duced into the chamber from a boiler. Below the steam chamber is another chamber equal in extent to the bottom of the bed or frame, into which the smoke from the stove which generates the steam is at once admitted on leaving the stove; this chamber is also provided at another part of it with a chimney or flue to permit the smoke to pass away. In order to heat hot-houses and other buildings used for growing plants or for other purposes, he forms an air chamber below the floor of the building, the air chamber being equal in extent to the floor. Below the air chamber is a smoke chamber, also equal in extent to the floor into which smoke is admitted from a fire-place or furnace, and allowed to pass away through a flue or chimney. The air in the air chamber is thus heated, and gratings or openings are formed in the floor which permit the heated air to escape into the building. *Patent abandoned.*

2645. H. Ellis. *Improvements in the manufacture of compounds of silica, and in the application of certain compounds of silica to mineralize woven fabrics, paper, and paper pulp, to harden and preserve stone and cement in the production of artificial stone and paint, and in the production and glazing of porcelain and such like manufactures.* Dated September 29, 1862.

To manufacture compound silicates, the patentee first precipitates the compound silicates out of solutions of silicate of soda, or of potash, by means of solutions of any of the salts of the metals, or of the earths. He then strains and washes the silicates so obtained; and while recently formed, or in the gelatinous state, he redissolves them in as much as may be sufficient of a solution of silicate of soda, or of potash, or of both. If the silicates have been allowed to get dry, he heats the mixture up to the boiling point to facilitate their solution. All gelatinous silicates, however obtained, may be made soluble in the above manner, and by addition of carbonates of soda or of potash. Solutions of the boro-silicates, phospho-silicates, and chromo-silicates he obtains by mixing saturated solutions of borate of soda, or chromate of potash, with an equal quantity by measure of solutions of silicates of soda, of potash, or of both, of about 1·2 specific gravity, and then precipitating by means of solutions of the metallic or earthy salts, and washing and redissolving the recent precipitates so obtained in the manner described. All the above compound soluble silicates may be reduced by evaporation into a gelatinous state, and preserved for use in that state in air-tight vessels. *Patent completed.*

2646. J. Bucknall. *Improvements in the construction of horse-hoes.* Dated September 29, 1862.

In this improved horse-hoe the patentee uses a cranked axle for the running wheels, and on any convenient part of this cranked axle is secured a worm wheel, into which gears a snail or worm, so that, by actuating this latter by means of a handle or lever adapted to its shaft, the cranked shaft may be turned round on its bearings, and by that means be raised or lowered, thereby raising or lowering the entire framework of the implement with the tines and other parts attached to the frame. The tine-bar is placed immediately below the cranked axle of the running wheels, and the tine levers are mounted on a round bar or shaft in front of the running wheels, the tine levers being secured thereon by means of tightening screws, so that their position on the round shaft may be altered and adjusted for the purpose of raising, lowering, or regulating the inclination of the points of the tines either in or out of the ground. In order to take the strain off the tine bar, draught-bars are adapted to the latter, and connected at their opposite ends to the shafts. The front round lever bar is suspended by links from two slotted bearings fixed to the framework of the implement, so that the front lever bar, and with it the lever and tines, may be moved laterally in either direction by means of a hand lever, which turns on a central pin as a fulcrum, its outer end being connected to both of the ends of the round front bar of the implement by means of suitable links and screw couplings. *Patent completed.*

2647. J. Addison. *Improvements in moorings or apparatus for securing articles, applicable also to the fixing of chairs for railways.* Dated September 29, 1862.

This invention consists in the use of plates of metal, of sizes proportioned to the strain likely to be exerted upon them, which are placed in pits made in the earth for their reception, prepared with a bottom of loose earth on which the plates rest, and into these pits, after the placing of the plates, sufficient water is admitted to lower the plates to create a perfect atmospheric pressure. *Patent completed.*

2648. R. A. Brooman. *Improvements in saddle-trees and collars.* (A communication.) Dated September 29, 1862.

This invention consists in making the sides of saddle-trees of several light pieces of wood united together, and with a space between the sides, which space is covered with leather, and the whole tree made as hereafter described. The two side frames are made of several thin flat pieces of wood, united in front by a curved piece of like material to fit over the withers of the horse, and by a similar piece for the back with the addition of the back pummel. The whole of the lower surface of this frame is covered with damp leather, which is bulged out between the side frames, and secured at the edges by pins; a wooden form is temporarily wedged in between the side frames to cause the leather while being dried to assume an arched form. When the leather is partially dry, it is cut and trimmed and sewn to the side frames; strips of leather are fitted all along the side frames and to the pummels, and the drying is completed in a stove or otherwise. A metal bow is rivetted or screwed to the front of the side frames passing over the arched leather; further back stirrup loops are attached, as also rings or other like additions, and the saddle-tree is complete. In the construction of collars, the inventor uses a strong wood mould made in one or two parts, with a metal flange secured to it, on which leather is laid. The leather is damp, and maintained to the shape of the mould by cords passing through holes formed in the flange. When dry, the mould is removed, and the rigid form of the leather is retained by a metal piece passed round its outer surface, and by a strong leather band by its inner surface, and the flange is consolidated by cords passing through holes in the metal piece, as well as round the leather band. The curvature of the leather is maintained by a piece of wood fitting under the cheeks. Thick padding is placed at top inside the collar, which is stuffed with straw, hair, or other material; outside the cheeks, and below the cheeks, there is a packing of felt, hair, caoutchouc, or other material, the whole being covered with leather. *Patent completed.*

2649. J. H. Johnson. *Improvements in shells for war purposes.* (A communication.) Dated September 29, 1862.

This invention relates to either spherical or elongated shells, and consists, firstly, in forming the main cavity of the shell by using a core of the form of a regular or nearly regular polyhedron, so as to leave the cavity with several plane or nearly plane faces, forming angles or corners at the junctions of these planes. By these means the shell is ruptured at each angle, and breaks into as many parts as there are planes in the walls of the cavity. Another improvement consists in causing the fuse-plug or tube to extend back into the centre of the cavity, thereby ensuring the firing of the charge at the centre of the shell first. This end of the plug is made of thinner metal, so that it will collapse and close so soon as it is acted upon by the explosion of the charge, thus preventing any loss of gas through the fuse. *Patent abandoned.*

2650. W. Carrick and W. Carrick, jun. *Improvements in felting apparatus.* Dated September 29, 1862.

This invention relates to a peculiar construction and arrangement of apparatus for planking felt hats and other goods, and consists in the use of a vessel with curved ends for containing the hats or other goods in process of felting, which vessel is fitted with one or more moveable or vibrating presses, suspended from a single point above, so as to cause them to describe an arc of a circle; or they may each be suspended from two points of oscillation, as may be found most expedient in practice, for giving a pressure and causing a continual revolving motion of the goods under treatment. The stroke or the size of the pressers may be varied, either by adjusting the length of the cranks which impart the vibrating motion thereto, or moveable pieces may be added to the faces of the pressers themselves, so that the pressure is always regulated to the bulk of the goods. *Patent completed.*

2651. R. Hoyle. *Improvements in machinery or apparatus for printing surfaces of woollen, mohair, cotton, and other fabrics.* Dated September 30, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2652. E. J. M. Le Breton. *An improved propeller for boats and ships.* Dated September 30, 1862.

This propeller may be worked by manual labour, steam engine, or other power, and may be fitted to any part of a boat or ship, and two propellers—one fitted at the stern to push, and the other at the bow to pull—may be advantageously worked together. The propeller itself consists of two flaps hinged to an upright in such a manner as to expand and expose the whole surface of the flaps when being driven in one direction, and to collapse and afford little resistance on being drawn or driven in the reverse direction. The upright to which the flaps are hinged is connected to rails protruded horizontally from the boat or ship on which it is free to travel to and fro. The upright is prolonged upwards for the reception of a shaft, to which to and fro motions are communicated by hand, steam engine, or other power. The upright is capable of oscillation for the purpose of causing the propeller to steer as well as propel. *Patent abandoned.*

2653. J. L. Hughes. *Improvements in producing ornamental patterns in gold and colour on porcelain, earthenware, glass, and enamel.* Dated September 30, 1862.

When producing ornamental patterns in gold on porcelain, earthenware, glass, or enamel, the patentee covers the whole surface of the article, or such part or parts thereof as is, or are intended to be, ornamented with gold, which he applies in the manner ordinarily practised by glass and china painters, and which is well understood, and he burns it on to such surface or part or parts thereof where the ornamenting is to be produced. On to the surface or parts thereof so coated with gold, he places a printed impression, taken by preference on paper from an engraved plate, or from other printing surface, such impression being taken in a bituminous or other varnish which will resist the action of acid. The impression is to be transferred on to the surface of gold and the paper removed therefrom, as is well understood in transferring impressions on china and glass. When the impression is set, he applies a liquid which will dissolve or loosen the gold where it is unprotected by the varnish of the impression. For this purpose he uses aqua regia, or fluoric acid—the acid should be diluted in the proportions of about one of acid to one of water—and in this manner the ornamental device or pattern is produced. *Patent completed.*

2654. A. Prince. *Improvements in the manufacture of varnish, printing ink, paint, and printing colours.* (A communication.) Dated September 30, 1862.

This invention consists in the use and application of petroleum, or the products thereof (instead of linseed oil hitherto in use), to the manufacture of varnish, printing ink, paint, and printing colours, and oil colours of every kind. Instead of natural petroleum, coal and schist oil, prepared in an artificial way, may likewise be applied. *Patent completed.*

2655. J. Wright. *An improved rotative travelling crane.* (A communication.) Dated September 30, 1862.

This invention is carried out as follows:—On a stand or framing of suitable weight and strength, the inventor places an engine and boiler, which, through a pinion on the main shaft, gives motion to a large cog wheel fastened on the spindle of the drum, on which is coiled the chain passing from it to the extremity of the jib, and terminating in a hook or its equivalent in the usual manner. A tie rod passes from the extremity of the jib to the extreme rear of the machine, by which means the weight of the boiler, engine, and the machinery counter-balances the weight of the substances or materials to be lifted. The whole apparatus turns on a circular rail round a pivot supported on a frame. The operation is as follows:—The chain is made fast to the substance or weight to be lifted, and the engine being put in motion coils the chain round the barrel or drum, thereby hoisting the weight. When it has been raised high enough, the crane is turned round on the circular rail before-mentioned by means of a steam cylinder mounted on the framing, and connected by means of toothed gearing with the axles of the wheels. When not in use, the crane can be transported from place to place by means of wheels which can be raised or lowered by the action of a screw, and when not in use they may be drawn up out of the way of the circular rail. *Patent completed.*

2656. G. Haseltine. *Improvements in warming and ventilating buildings.* (A communication.) Dated September 30, 1862.

This invention consists, mainly, in an arrangement for warming to a moderate and pleasant degree the floor and lower part of the walls, when necessary, in connection with an arrangement for the admission and general diffusion at or near the floor of air warmed only to the temperature at which it is wanted for respiration (say fifty or fifty-five degrees, more or less), by being made to pass in contact with a very large non-metallic warming surface, kept at a moderate temperature, a temperature not higher than that to which nature warms the earth's surface in summer. This fresh air, being admitted at a temperature a little lower than the general temperature of the air in the room, will remain in the lower part of the room, where it is wanted for respiration, and not ascend at once to the ceiling (where it can neither be heated nor serve for warming), as is the case with highly heated air from steam pipes and hot water pipes, as well as from furnaces and stoves, thus wasting the heat upon the ceiling and upper parts of the room, and forcing the foul air (which should be the lightest air in the room and rise uppermost) downward to be inhaled. *Patent completed.*

2657. P. G. V. Byl. *A power conserver brake for utilizing the power expended in stopping or retarding machinery, locomotive or other engines, and vehicles of any description when in motion.* (A communication.) Dated October 1, 1862.

This invention consists in constructing apparatus for stopping or retarding machinery, locomotive and other engines, carriages, trucks, vans, and vehicles of any description used on railways or on common roads, in such a manner that the power which is expended by such stopping or retarding is accumulated or stored up by the apparatus, and given out again by the same when it is required to start the machines, engines, or vehicles again, so as to assist them in their motion. The arrangement of apparatus for carrying out the principle of this invention admits of various modifications to suit the particular machines, engines, or vehicles to which it is applied. *Patent completed.*

2658. R. W. Greenwood and C. J. Marson. *A new and improved mode of using the exhaust steam of steam engines by reconveying the same into the boiler.* Dated October 1, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2659. B. Donkin. *Improvements in bearings for shafts, axles, pivots, and sliding surfaces for the purpose of diminishing friction.* (A communication.) Dated October 1, 1862.

This invention consists in providing a water or liquid bearing for shafts, axles, pivots, and sliding surfaces by a continuous circulation of liquid forced between a metal box and the shaft, axle, pivot, or sliding surface, so as to prevent contact of surface with surface, whatever be the material constituting such surfaces. The inventor takes a box or case shaped to correspond with the shape of the revolving or sliding surface to be used with it, and forms therein a central cavity followed by several concentric, quadrangular, or other cells, according to the surface. He makes an orifice in the central cavity to allow of the inlet of water or other liquid under pressure. *Patent completed.*

2660. E. Lord. *An improvement in power looms for weaving.* Dated October 1, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2661. W. C. Cambridge. *Improved apparatus for washing clothes, applicable also as a churn.* Dated October 1, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2662. J. Gilchrist. *Improvements in boring engines such as are used for mining purposes.* Dated October 2, 1862.

In one modification of this improved engine, the principal parts are fitted upon a framing which is by preference mounted upon wheels. The parts comprise a steam boiler, winding details, with actuating cylinder or cylinders, and a cylinder for imparting the required reciprocating motion to the boring rods. This last-mentioned cylinder—which may be fixed or oscillating—is disposed horizontally, and its piston rod actuates the vertical arm of a bell crank lever, centred on a fulcrum or on journals at a higher level than that of the cylinder, and having its other arm projecting horizontally outwards over the bore, and being connected to the boring rods. The steam may have access to both sides of the piston, its action on both sides or on one side only being regulated by a suitable valve actuated by hand or by the movement of the piston rod itself; or the steam may be allowed access to only one side of the piston. The arms of the bell crank lever need not in all cases be at right angles to each other, but may in some cases be arranged to suit a diagonal or inclined position of the actuating steam cylinder. When the boring rods have to be drawn out of the lever, the bell crank lever may be disconnected and turned out of the way. *Patent abandoned.*

2663. W. H. Ward. *Improvements in night, day, and fog signals, and in the means for effecting the same.* Dated October 2, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2664. W. C. Wilkins. *Improvements in gas-burners.* Dated October 2, 1862.

This invention relates, partly, to an adaptation or combination of parts when using burners formed of two or more concentric rings perforated for the escape of the gas for combustion. Each ring of the burner is supplied from a separate reservoir or chamber through two or more branch passages, which branch passages vary in number with the size of the ring with which they communicate, and each of such reservoirs is supplied by a separate pipe or channel with a tap or valve adapted to regulate the quantity of gas for the time to be supplied to such reservoir. By these means the quantity of gas supplied to any part of the respective rings is rendered uniform, and that to any one ring is capable of being regulated in relation to that supplied to the other ring or rings. The inventor applies with such burner a glass chimney contracted somewhat at a distance a little above the burner rings, and he applies adjusting means to adjust the height of such contracted part; he also applies fine wire gauze or other fine reticulate open work to regulate the supply of air upwards to the burner, and he applies a fence between such reticulate open work and the glass chimney. *Patent abandoned.*

2665. E. Suckow and E. Habel. *Improvements in machinery for preparing, spinning, and doubling fibrous materials.* Dated October 2, 1862.

This invention relates to mechanism for twisting a sliver or thread, and at the same time winding it upon a bobbin; and it consists in a combination and arrangement of mechanism by which the bobbin is simultaneously rotated upon its own axis, so as to wind and distribute the thread upon it, and revolved in a plane passing through its axis to put the twist in the sliver or thread. *Patent abandoned.*

2666. J. H. Johnson. *Improvements in the permanent way of railways.* (A communication.) Dated October 2, 1862.

This invention relates to an improved form of railway chair and construction of joint for the rail ends, and consists in casting the upright jaw of the chair which is on the inside of the rail separate and distinct from the plinth of the chair, and of a wedge form. The outer jaw is cast on the plinth in the usual manner, and the upper part of the plinth on the inside of the rail is made with a raised tablet which acts as a butt to the wedge jaw which is inserted between it and the rail, thereby firmly holding the rail in its position. This wedge jaw is locked by a screw bolt passing through it and the plinth, and screwing with one oblong wrought-iron nut inserted on the under side of the plinth. When stone block sleepers are used, the chair plinth at that part upon which the rail rests is made to receive a cushion of lead or other suitable material, thus preventing immediate contact between the rail and the upper part of the chair plinth. This lead or other cushion is retained in its place by the moveable jaw of the chair; the chair itself is secured to the stone block by the screw bolts passing up through the stone and the plinth of the chair, and a nut screwed on above. *Patent abandoned.*

2667. G. J. Firmin. *Improvements in the treatment of certain salts of potash and lime.* Dated October 2, 1862.

This invention consists in utilizing the waste liquors arising in the manufacture of tartaric and citric acids, to obtain therefrom suitable products, as follows:—The usual method of manufacturing tartaric or citric acid is to saturate bitartrate of potash or lemon juice with bicarbonate of lime, and to treat the resulting tartrate or citrate of lime with sulphuric acid to obtain the tartaric or citric acid. According to this invention, the patentee recovers the tartaric acid contained in the liquid, and this he does by adding to it sulphuric acid. *Patent completed.*

2668. F. Ensor. *A new or improved apparatus for regulating the pressure of steam in steam boilers, and for indicating when the water in steam boilers is too high or too low.* Dated October 3, 1862.

We cannot here give space to the details of this invention. *Patent abandoned.*

2669. J. Harrop and J. Wadsworth. *Improvements in deodorizing refuse, organic, fecal, and urinous matters, and in a method of utilizing coal and other ashes, and in machinery or apparatus connected therewith, for producing a portable manure therefrom.* Dated October 3, 1862.

This invention consists—1, In the use and application of chloride of sodium (muriate of soda, or common salt) either dry, cystallized, or in a solution, as a disinfectant or deodorizer; also in the admixture with chloride of sodium (muriate of soda, or common salt), either dry, cystallized, or in a solution, of any resinous, sooty, earthy, vegetable, metallic, or alkaline matters (except oleaginous matters) as a disinfectant or deodorizer, for the purpose of deodorizing and preventing the generation and escape of noxious effluvia in refuse, organic, fecal, and urinous matters, and by so doing to remove or prevent the exhalation of the noxious effluvia. 2, The invention consists in converting such refuse, organic, fecal, and urinous matters into a concentrated portable manure, as follows:—In order to prevent the escape of the free ammonia from the excremental fecal and urinous matters in the process of manufacture, the inventors neutralize or combine the said free ammonia with the hydrochloric acid (muriate acid, or spirit of salt) of commerce, and further, by the process of evaporation in stills, pans, or boilers, by the aid of steam and hot and cold currents of air, and the application of a steam pump, for the purpose of exhausting rapidly the generated steam or vapour produced by evaporation of the fecal urinous matters in the stills, pans, or boilers. They also compound or mix with such produce the common ashes or cinders of coal, wood, peat, or other fuel collected from dwelling-houses, warehouses, offices, and works. *Patent abandoned.*

2670. T. J. Robotham. *Improvements in apparatus for purifying "glaze," "slip," or other potters' materials.* Dated October 3, 1862.

This invention consists, principally, of a vertical shaft with four or more longitudinal or inclined arms projecting therefrom, and provided with any convenient number of permanent or electro magnets, which shaft is caused to revolve (by means of any suitable gearing) in a vat or circular vessel containing the glaze or other material, so as to come into contact with, and take up every particle of, iron or other magnetic substance that may be incorporated therewith. *Patent abandoned.*

2671. R. Broadbent. *Improvements in gas regulators.* Dated October 3, 1862.

The documents relating to this invention cannot at present be seen, an extension of time for filing the final specification having been petitioned for.

2673. W. Clark. *An improved candlestick.* (A communication.) Dated October 3, 1862.

This invention relates to an improved candlestick lamp, or other similar apparatus in which the candle, taper, or oil reservoir always preserves a vertical position, whatever may be the direction in which the body of the candlestick, lamp, or holder is inclined. This improved apparatus will be found of great advantage for sea service, or in mining operations, as there is no liability to spill the oil or other fatty matter made use of, the candle or wick holder always preserving its vertical position. For this purpose, the inventor fixes a stem to the lower part of the candlestick or oil reservoir, and supplies a weight at the lower end thereof of sufficient gravity to keep the candle or other light upright. *Patent completed.*

2674. W. E. Gedge. *An improved suction and life pump, and apparatus connected therewith.* (A communication.) Dated October 3, 1862.

This pump—which may be single or double—is essentially composed of a cylindrical hollow and water-tight piston. The air which it contains communicates with the atmospheric air by small tubes; it has at its lower extremity an iron box or cup, and its packing is of gutta percha. *Patent abandoned.*

2675. A. Dalrymple. *Improvements in the processes of depositing metals by galvanic action, either with or without the aid of galvanic batteries, and in the ornamentation of metal surfaces thereby.* Dated October 3, 1862.

We cannot here quote the details of this invention. *Patent abandoned.*

2676. W. E. Gedge. *An improved marquetry or veneer saw, and machinery or apparatus connected therewith.* (A communication.) Dated October 3, 1862.

This invention consists of a marquetry or veneer saw or veneering web advantageously arranged for boring or drilling, turning, and sharpening. The saw is composed of five principal parts, which are:—A fly wheel fixed on a horizontal shaft resting on two vertical uprights; a large wheel fixed also on a horizontal shaft bent at one of its extremities to form a crank, the whole surmounted by two vertical uprights more elevated than the fly wheel; a moveable wooden plate or bed; and, lastly, a wooden pedal. The blade of the saw is about 5½ in. in its entire length, about 4 in. of which are toothed. The teeth, which are in form of a triangle, without any setting or edging, project about the 50th part of an inch, and are about the 25th part of an inch apart, which is also the entire breadth of the blade. *Patent abandoned.*

2677. T. Greenwood. *Improved machinery for cutting staves.* Dated October 3, 1862.

The object of this invention is to facilitate the operation of cutting or shaping staves from planks of wood, such staves being intended to be applied as a cylindrical covering for metal casks, and for analogous uses. To this end the patentee submits the wood to a sawing machine, which at one operation will cut the bevelled edges of the staves. The machine is provided with a double set of oblique saws, the shafts of which are inclined in opposite directions, but at the same angle; and for the purpose of bringing the cutting edges of each set on a level, or nearly so, he makes the saws of varying diameters. *Patent completed.*

2678. J. and W. Lee. *Improvements in traction engines and boilers for traction, locomotive, and other purposes.* Dated October 4, 1862.

These improvements in traction engines, under one modification, consist in giving motion to the main or driving pair of wheels by a pinion on the crank shaft of the engine gearing into an intermediate wheel, on the axis of which is another smaller wheel which gears into a toothed wheel on the axis of the main or driving wheels. The intermediate wheels turn on a stud which projects from the bracket which carries the crank shaft; this stud, the crank shaft, and the axis of the main wheels, are so placed that their centres are all in one vertical line. The improvements in boilers for traction, locomotive, and other purposes consist in constructing them so that the horizontal tubes which pass from the fire box conduct the products of combustion into a smoke box or chamber, from the top of which they pass away through vertical tubes which rise up through the dome or steam chamber of the boiler, and on the exterior of the dome the tubes open into a chimney which can be turned down when the tubes require cleaning. The smoke box or chamber above mentioned is formed by the plate which receives the ends of the horizontal tubes from the fire box, being bent at right angles, the portion bent down at right angles receiving the vertical tubes which rise up through the dome. *Patent completed.*

2679. W. H. Muntz. *Improvements in armour for the protection of ships of war, and other vessels and fortifications, from the effects of cannon shot and other projectiles.* Dated October 4, 1862.

This invention consists in protecting such vessels or fortifications by means of armour composed of elastic material which absorbs, instead of resisting, the force of the projectile, and stops it gradually instead of suddenly. This elastic armour may be made either of a solid elastic substance, such as vulcanized india-rubber, or of hollow cases or mattresses of vulcanized india-rubber, or other similar material, stuffed or filled with cotton or other elastic or compressible substance, which may be rendered incombustible by chemical means; or the cases or mattresses may be filled with atmospheric air either combustible or otherwise. The edges of the mattresses or cases should be made in the form of a scarf joint so that they overlap each other and still preserve an even surface on the exterior. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Dec. 4, 1862.

3248. C. H. Roeckner, Bristol. An improved method of constructing coffer dams and other similar structures for excluding or keeping back the flow of water and preventing inundations.

Dated Feb. 9, 1863.

355. H. G. Williams and R. G. Price, Bontdu, near Dolgelly, mining engineers. An improved machine for crushing and amalgamating auriferous quartz, and pulverizing and washing ores.

Dated Feb. 11, 1862.

474. R. Saunders, Croydon, gentleman. Improvements in pavements and floors, which improvements are also applicable to stairs or steps.

Dated March 2, 1863.

580. A. F. Pagny, 15, Passage des Petites Ecuries, Paris, gentleman. A new agricultural implement for cultivating tubercles, roots, and all oil plants.

Dated March 14, 1863.

695. R. Alexander, Islington, Liverpool. Improvements in mariners' compasses, and the parts in connection therewith, and in the application thereof to magnetic instruments.

Dated March 16, 1863.

737. J. Smethurst, Royton, coal proprietor and millowner. Improvements in the construction of ships and vessels, for the purpose of obtaining additional strength and motive power.

708. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the manufacture of iron and steel. (A communication.)

Dated March 18, 1863.

727. B. Wren, Stockton-upon-Tees, corn miller. Improvements in cleansing and treating certain descriptions of wheat and other grain.

728. E. Legris, Bondeville, France, engineer. A new or improved machine for thrashing out the seed of flax.

731. W. Lorberg, Wyld's-rents, Bermondsey, analytical chemist. Improvements in the treatment of rags, and obtaining valuable chemical products from the animal fibre therein.

Dated March 20, 1863.

743. R. Couchman, 6, Noble-street, St. Martin's-le-Grand, manufacturer. Improvements in articles or means for supporting or carrying ladies' parasols, bags, or other articles or appendages.

747. V. Houghton, 2, Merton-road, Kensington. Improvements in lamps and lamp wicks. (Partly a communication.)

Dated March 21, 1863.

756. G. A. Biddell, Ipswich, mechanical engineer. Improvements in locomotives, usually called "traction engines," to be used on common roads.

761. W. Clark, 53, Chancery-lane, engineer. Improvements in the separation or obtaining of ammonia from azoted matters in the preparation of manure. (A communication.)

Dated March 27, 1863.

806. J. D. Asquith and G. Greenwood, Morley, near Leeds. Improvements in rag machines.

Dated March 28, 1863.

812. A. Blouin, Rue du Faubourg du Temple, Paris, mechanician, and D. N. Mercier, 10, Rue Richelieu, Paris, medical doctor. An improved axle-tree, with linked levers for lifting.

Dated March 31, 1863.

830. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in electric telegraph printing apparatus. (A communication.)

Dated April 1, 1863.

836. I. Rowland, Salford, Lancaster, committee clerk. An improved mileage apparatus for measuring and registering the distances public vehicles or private carriages travel.

842. G. T. Bousfield, Loughborough-park, Brixton. Improvements in steam boilers. (A communication.)

844. R. Gavin, Edinburgh, wine merchant. Improvements in the preservation of perishable liquids during the withdrawal or consumption thereof.

Dated April 2, 1863.

846. J. W. Law, and J. Inglis, Glasgow, ironfounders. Improvements in making moulds for casting, and in apparatus connected therewith.

848. D. S. Sutherland, 34, Great George-street, Westminster, civil engineer. Improvements in protecting vessels of war and fortifications from the effects of projectiles.

850. J. J. Pôtel, St. Quentin, France, engineer. Improvements in furnaces and fire-places, having for object the consumption or prevention of smoke.

852. G. A. Cox, Lochee, Dundee, jute and flax spinner and power-loom linen manufacturer. Improvements in the treatment or preparation and manufacture of jute, hemp, flax, and other fibrous or textile materials.

854. A. B. Seithen, 5, Mansfield-place, Kentish-town. Improvements in casings, covers, or wrappers for bottles, jars, and other articles.

Dated April 4, 1863.

858. J. Silvester, West Bromwich, manufacturer. Improvements in attaching guards to pressure gauges.

860. W. E. Gedge, 11, Wellington-street, Strand. Improved apparatus for bolting flour. (A communication.)

862. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved construction of pressure guaga. (A communication.)

Dated April 6, 1863.

864. F. C. Bakewell, 6, Haverstock-terrace, Hampstead. Improvements in wicks for lamps. (A communication.)

866. T. Burrow, Albert-place, Brighouse, near Normanton, York, silk spinner. Improvements in, and machinery for, combing or dressing silk, flax, wool, hemp, China grass, or other fibrous materials.

868. M. Henry, 84, Fleet-street. Improvements in probes, catheters, and similar surgical instruments. (A communication.)

870. J. Burwin, Keighley, shuttle and picker manufacturer. Improvements in pickers, and in the means or apparatus employed in the manufacture thereof.

Dated April 7, 1863.

874. A. C. Bamlett, Ripon, agricultural engineer. Improvements in reaping and mowing machines.

878. R. A. Brooman, 166, Fleet-street. Improvements in the manufacture of baryta and its derivatives, in obtaining by-products, and in revivifying or recovering certain agents employed in such manufacture. (A communication.)

Dated April 8, 1863.

882. G. H. and W. R. Hill, Bolton, boiler makers. Improvements in steam boilers.

884. J. Mosheimer, Dolgelly, gentleman. Certain improvements in machinery or apparatus for crushing, grinding, and dressing metallic ores, quartz, and other similar substances.

888. W. E. Gedge, 11, Wellington-street, Strand. Improvements in apparatus for propelling and navigating small craft. (A communication.)

890. J. L. Norton, Belle Sauvage-yard, Ludgate hill. Improvements in machinery for washing and drying wool and other fibres and rags.

Dated April 9, 1863.

892. H. B. Fox, Liverpool, Lancaster. Improvements in dish covers.

902. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved construction of offensive weapon. (A communication.)

904. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improvement in stirrups, and in the mode of attaching the same to saddles. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated April 10, 1863.

906. S. A. Couperie, Bordeaux, France, gentleman. A semicircular metallic slide, whereby the pole bolt is effectually suppressed, and which can be adapted to every four-wheeled vehicle.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, April 21, 1863.

3273. G. Wright. Food for cattle.

3288. C. Sanderson. Manufacturing bands for driving machinery.

3292. E. T. Hughes. Galvanic apparatus. (A communication.)

3303. P. Effertz. Making bricks, tiles, and drain pipes.

3304. W. E. Newton. Firearms. (A communication.)

3313. D. Chalmers. Manufacture of textile materials.

3316. J. King. Signalling.

3317. E. Toynbee. Extracting oils and fatty matters.

3319. W. Tristram and H. Brereton. Sizing yarns and threads.

3320. J. R. Breckon and T. Douglas. Manufacture of firebricks.

3321. R. A. Ronald. Printing textile and felted fabrics.

3325. W. Goulding. Ploughs.

3330. J. Gaskell and H. Walmsley. Regulating the tension of yarn in the processes of warping, winding, sizing, weaving, and other similar purposes.

3334. S. Fox. Manufacture of gas.

3344. M. Henry. Propellers. (A communication.)

3345. M. J. Roberts. Preparing and spinning fibrous substances.

3349. W. Phelps. Locks.

3354. J. Varley and J. Crowther. Steam engines.

3365. R. Hattersley. Classing printers' types for composing machines.

3367. A. Albini. Breach-loading firearms.

3372. J. Ramsbottom and G. Hacking. Measuring and registering the flow of water and other fluids.

3373. J. W. Hadwen. Spinning, twisting, and doubling fibrous materials.

3375. F. De Wyldé. Improved means for the protection and preservation of lead surfaces exposed to the action of water. (A communication.)

3378. L. Latter. Ploughs.

3381. J. Clayton. Furnaces for heating large masses of iron and steel.

3389. J. Pernod. Purpurine.

3391. J. Longland. Street lamps.

3394. I. Holden. Preparing and combing fibres.

3395. I. Holden. Washing fibres.

3401. J. Dalton. Knitting machinery.

3404. A. T. Blakely. Breech-loading ordnance.

3419. J. B. Dalhoff. Cutting files.

3432. G. H. Birkbeck. Surveying and levelling. (A communication.)

3435. A. P. Tronchon. Firearms.

3439. W. Clark. Applying heat. (A communication.)

3452. W. Clark. Firearms. (A communication.)

3471. J. Robson, jun. Stove grates.

1. R. H. Collyer. Manufacture of paper and similar purposes.

84. M. Henry. Furnaces. (A communication.)

97. W. Clark. Preparations of green colouring matter. (A communication.)

110. C. E. Amos. Manufacture of paper.

140. A. Prince. Sewing machines.

177. J. W. Meears. Sash frames and sashes.

417. W. C. McEntee and T. Withers. Locks.

654. Sir A. Keller. Reeling silk direct from cocoons on bobbins.

674. F. B. Kraushaar. Winding, cleaning, measuring, sorting, doubling, throwing, and reeling silk.

717. G. De Laire. Manufacture of brown colouring matters. (A communication.)

752. F. De Wyldé. Cement from gypsum.

764. W. Johnson. Lighting and heating.

765. T. G. Grant. Ovens and apparatus.

862. G. A. Cox. Manufacture of fibrous or textile materials.

878. R. A. Brooman. Manufacture of baryta and its derivatives. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed April 17, 1863.

2814. R. A. Brooman.
2816. W. E. Gedge.
2819. G. Haseltine.
2821. J. Clark.
2823. W. A. Turner and T. T. Coughin.
2825. H. L. Emery.
2826. J. H. Johnson.
2831. S. Witham and T. Wright.
2832. C. G. Clarke.
2834. J. T. Cooke.
2835. R. A. Brooman.
2838. G. Haseltine.
2840. C. T. and F. C. Belhomme.
2842. J. Spence.
2848. T. Fearn.
2860. E. H. Carbutt and G. A. Clough.
2887. F. Lipscombe.
2909. G. Darlington.
2912. W. Clark.
2939. G. Dickinson and E. Cooke.
2946. G. Speight.
2965. L. Gonez.
3032. W. E. Newton.
3033. J. Easton, jun., and J. C. Amos.
3146. A. V. Newton.
3190. F. Boecke.
3264. T. E. Blackwell.
257. J. H. Johnson.

Sealed April 21, 1863.

2851. J. T. Stroud.
2852. W. S. Gamble.
2853. A. Chaplin and G. Russell.
2858. H. Rée.
2862. R. A. Brooman.
2870. P. S. Devlan.
2871. G. and W. Luke.
2873. W. Owen.
2883. J. Chattwood.
2886. H. C. R. Joubert.
2888. W. J. Williams.
2890. F. L. H. W. Bünger.
2913. W. Clark.
2948. T. Gibson, T. Hall, and T. Davison.
2958. E. Stevens.
2963. J. Musgrave.
2968. E. Humphrys.
3011. W. Clark.
3034. T. G. Ghislin.
3106. R. Mushet.
3156. N. J. Amies.
3195. J. F. Delany and J. C. R. Okes.
3222. E. D. Johnson.
3418. M. Clark.
160. Sir W. O'S. Brooke.
176. S. Blackwell.
191. N. Clayton and J. Shuttleworth.
270. N. Clayton and J. Shuttleworth.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

922. J. Platt.
933. J. J. L. Brémond and L. Z. Thuilliez.
939. A. Jones.
943. Sir J. S. Lillie.
1124. J. Grimond.
958. T. Turner.
974. J. Fowler, jun., W. Worby, and D. Greigg.
980. B. Lauth.
984. J. Willis.
1083. H. Rawson.
1088. G. T. Bousfield.
1090. H. Hutchinson.
1020. D. G. Berri.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

897. W. Smith.
948. J. Nasmyth and H. Minton.
923. W. Tytherleigh.
989. F. W. Blacket.
1194. A. V. Newton.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending April 18, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2334	0	8	2489	0	6	2501	0	8	2513	0	4	2524	0	4	2535	0	4
2432	0	4	2490	0	4	2502	0	8	2514	1	6	2525	0	6	2536	0	8
2438	0	4	2491	0	10	2503	0	6	2515	0	4	2526	0	10	2537	1	2
2453	0	4	2492	0	10	2504	0	4	2516	1	0	2527	0	10	2538	0	4
2481	1	6	2493	0	8	2505	0	4	2517	0	4	2528	0	4	2539	0	4
2482	0	4	2494	0	10	2506	2	0	2518	0	4	2529	0	6	2540	1	2
2483	0	4	2495	0	10	2507	1	4	2519	0	10	2530	1	6	2541	0	8
2484	0	8	2496	0	4	2508	0	4	2520	0	8	2531	0	10	2542	1	0
2485	0	10	2497	0	8	2509	0	8	2521	0	4	2532	0	6	2544	0	4
2486	0	10	2498	0	4	2510	0	10	2522	0	8	2533	1	6	2545	0	4
2487	1	4	2499	0	4	2511	0	10	2523	0	4	2534	0	8	2546	0	4
2488	0	4	2500	0	4	2512	0	10									

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Timber, duty 1s. per load, drawback 1s.

	£	s.	£	s.		£	s.	£	s.
Teak............load	£14	0	£15	0	Archangel, yellow ..	£13	0	£13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
„ yellow pine .	3	0	4	0	Finlan	9	0	10	0
St. John, N.B., yellow	5	0	5	10	Memel	10	0	15	0
Quebec oak, white ...	5	10	6	10	Gothenburg, yellow	10	0	11	0
„ birch	3	0	3	10	„ white.	9	0	9	10
„ elm	3	10	5	0	Gefle, yellow	10	0	11	10
Dantzic oak	3	10	6	10	Soderhamn........	9	10	10	10
„ fir	2	10	3	10	Christiania, per C., 12ft by 3 by 9 in.				
Memel fir	3	0	3	5					
Riga......	3	0	3	5	Christiania, yellow	21	0	23	0
Swedish	2	10	2	15	Deck Plank, Dantzic,				
Masts, Quebec red pine	5	0	6	0	per 40 ft. 3 in.	0	14	1	4
„ yellow pine	5	0	6	0	Pumice Stone pr ton	5	10	9	8
Lathwood, Dantzic, fm	5	10	6	10	Oils, &c.				
„ St. Petersburg	8	0	8	10	Seal, pale ...per tun	46	0	0	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	82	0	82	10
					Cod........	47	10	48	0
					Whale, Sth Sea, pale	44	0	0	0
Quebec, white spruce	15	10	19	10	Olive, Gallipoli	58	10	59	0
St. John, white spruce	14	10	10	10	Cocoanut, Cochin...	52	0	0	0
Yellow pine, per reduced C.					Palm, fine	37	0	0	0
					Linseed........	43	0	0	0
Canada, 1st qual. ...	17	0	18	0	Rapeseed Eng. pale	53	0	0	0
„ 2nd do......	11	0	12	0	Cottonseed	31	0	[illegible]	0

Metals.

		£	s.	d.		£	s.	d.	p ct.
Iron:—									
Welsh Bars, in London	per ton	6	10	0	to	0	0	0	2½
Nail Rods	do	7	0	0		7	5	0	
Hoops........	do	8	10	0		8	15	0	
Sheets, single	do	9	10	0		9	15	0	
Staffordshire Bars........	do	7	10	0		8	0	0	
Bars, in Wales........	do	5	10	0		5	17	6	
Rails	do	5	12	6		6	0	0	nett
Foundry Pigs, at Glasg, No 1	do	2	11	0		2	16	0	
Swedish Bars	do	11	10	0		12	0	0	2½
Steel:—									
Swedish Keg, hammered ...	do	16	0	0		0	0	0	
Swedish Faggot	do	17	0	0		18	0	0	
Copper:—									
Sheet & Sheathing, & Bolts...	do	96	0	0		0	0	0	3
Hammered Bottoms........	do	106	0	0		0	0	0	
Flat Bottoms, not Hamrd....	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	8½	
Fine Foreign	per ton	94	10	0		96	0	0	
Tin:—									
English Block........	per cwt.	5	19	0		0	0	0	2½
do Bar........	do	6	0	0		0	0	0	
do Refined........ ..	do	6	4	0		0	0	0	
Banca........	do	6	8	0		0	0	0	nett
Straits........	do	6	2	0		6	3	0	
Tin Plates:—									
Best Charcoal, I.C........	per box	1	8	6		1	9	6	3
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
Lead:—									
Pig, English........	per ton	20	10	0		23	0	0	2½
„ Spanish Soft	do	19	10	0		0	0	0	
Shot, Patent........	do	23	15	0		21	0	0	
Sheet	do	21	10	0		0	0	0	
White	do	27	0	0		0	0	0	
Spelter:—									
On the spot	do	18	0	0		0	0	0	nett
Zinc:—									
English Sheet	do	23	10	0		0	0	0	2½
Quicksilver........	per btl.	7	0	0		0	0	0	3
Regulus of Antimony:—									
French star	per ton	42	0	0		0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 1, 1863.

WATER-GAUGES.

Although it is quite certain that a red-hot fire-box cannot generate sufficient steam to explode a boiler, it is equally certain that any over-heating due to too low a water level, is not only injurious, but, if often repeated, absolutely destructive to either the bottom plates of a boiler, or the top of a fire-box, as the case may be; hence a few words on the best means of ascertaining at all times the precise level of the water within a boiler, may not prove uninteresting.

Were it possible to construct a boiler of glass, many phenomena doubtless, connected with the relative generative powers of different regions of the boiler, the mode in which priming takes place, the deposit of sediment &c., would become so evident to a careful observer, that many useful deductions might be drawn from the information so gained; but as boilers are invariably constructed of opaque materials, all information regarding the state of affairs within, must be described from sources more or less indirect. A patent has, it is true, been taken out for the application of a powerful lens—or telescope, in fact—by means of which the observer, aided with a strong light cast within the boiler, by a lamp and a second lens, can wholly or partially learn all that goes on within; such an invention not being likely to meet with very general adoption, we need not dwell further on its merits or demerits, but turn to those water-gauges met with in daily use.

The first we have any mention of in the history of the steam engine is the single gauge, cocks, first applied by Savery in the year 1698. Its application was sufficiently obvious—it was merely making a hole in the side of a vessel through which water would flow when it had reached it. Shortly afterwards Savery employed two of these cocks in order that the water level might be ascertained with greater accuracy. These gauge-cocks are in use to the present day, but, in our opinion, frequently do more harm than good; it is almost impossible, when the steam is of any considerable pressure, to ascertain whether water or steam escapes from them. Water, by its contained heat, is almost instantly dissipated in spray and steam when the lower cock is opened; and as it always rises to any opening near its level, the upper cock will discharge it plentifully, even though the real water level is at the instant several inches below it; hence they are almost totally useless for tubular boilers, unless we adopt some such arrangement as that employed by Mr. Gooch in some of his locomotives. He affixed a brass tube of small diameter to the boiler in exactly the same way that a glass guage is fitted; into this tube the gauge-cocks are screwed. In order to test the level of the water, open both cocks communicating with the vertical pipe for a few minutes, then close them, and open a small cock on the top of the tube, which will discharge the steam contained in it; then, on opening the gauge-cocks, the exact level of the water within the tube, and of course within the boiler, may be ascertained with certainty as the water issues quietly by its own gravity from the gauge-cocks.

The ordinary gauge-cocks may sometimes be applied with propriety to large boilers without inside flues, as the variation of the water level through a range of nine or ten inches, is seldom of much importance, and in many situations where boilers get little cared for and glass gauges are liable to be broken, they possess a certain amount of value.

But the most popular gauge for such situations, and indeed the only one used in many parts of England, is the float; only applicable to stationary boilers, of course. This, if properly constructed at first, and treated with moderate care afterwards, we are inclined to consider second to none; its cleanliness, and the large range of indication which it gives, render it an extremely valuable instrument; but, when badly constructed and neglected for long periods, it is undoubtedly more likely to give false indications than the glass water-gauge. The most usual arrangement is a stone float suspended from a wire, which, passing through a stuffing-box, is attached to a small chain, which runs over a light iron pulley, a foot or more in diameter—the other end of the chain carrying a weight which partly balances the stone within the boiler, so as to keep it floating; but as the stone is seldom very large, and acts directly on the wire, it is very easy, by screwing the gland of the stuffing-box too tight, to render it altogether inoperative. The use of iron wire in such a situation, will also be certain to induce corrosion, and the consequent destruction of the stuffing in the box.

The proper method of fitting a float is undoubtedly the following:—Let a lever of considerable length be hung on a fulcrum within the boiler; one end of this lever must be so bent as to reach above the water level, and must carry a cast-iron ball, sufficiently heavy to balance enough of the weight of a float, moulded and burned in hard brick, fixed to the other end, that it shall be only half immersed in the water. Outside the boiler a light index lever must be fitted, to the short end of which a fine brass wire is attached, and being passed through a small brass stuffing-box, is fastened to the float lever within the boiler close to the fulcrum; any amount of friction in the stuffing-box can scarcely affect the action of the float, from its powerful leverage; and the light index outside can be made to traverse through a sufficient distance to show the most minute variations in the water level.

A very efficient float indicator can also be made by fixing a hollow ball sufficiently strong to stand the pressure, and light enough to float, on the end of a lever, of very considerable length, which will lie parallel to the axis of the boiler. The fulcrum of the lever must consist of a brass ball fitted into a stuffing-box on the boiler end, the lever being prolonged a few inches through the stuffing-box, and attached as before to a suitable index. It would be impossible, from its great leverage, to set this float fast, no matter how tightly the packing might be screwed down, and a good india-rubber stuffing would last many months, owing to the almost inappreciable amount of motion in the ball. Such a gauge would, we have no doubt, be certain in its action, and could scarcely get out of order.

The most generally applicable of all, is undoubtedly the glass tube, which, for boilers in motion, such as locomotives, marine boilers, &c., is absolutely invaluable. Its mode of application deserves far more attention than it usually receives, the almost invariable practice being to fit it to the fire-box end of boilers, from the belief that there it will show exactly the amount of water over the fire-box, and because practically it is almost the only place where suitable space can be found for it; but as the water level is always very unsteady thereabouts, its indications are seldom very accurate, especially if the engine draws its steam from the same end of the boiler. In traction engines, in particular, we have seen the gauge fill and empty many times in a minute from the oscillation of the water, due to a rough road in a great measure. We would recommend the use of two tubes—one extending horizontally from the top of the glass nearly to the forward end of the boiler, where ebullition is least; the other in a similar way from the bottom of the glass. The end of this last should, of course, be suspended exactly at the minimum water level; and the tube should slope from the gauge the whole way, so that water may not lodge in it and cause a false indication.

Glass gauges are unhappily very liable to become stopped up, by the connections with the boilers getting filled with sediment; a remedy is not easily found, as any enlargement of the holes in the cocks and connecting-pipes might lead to very serious results should the glass tube burst. Some difficulty, too, is is found in getting tubes which will keep clear under a very heavy pressure; we have seen four tubes put in one after another in a locomotive working with 130 lb. steam in the course of an hour, although the same glasses answered admirably in a boiler working with 25 lb. steam; very high-pressure steam dissolves the glass, rendering it dim, soft, and brittle. Green glass tubes are far the best.

Some makers case their gauge in a slotted brass tube; we do not advocate the practice, none but an awkward fireman will break them by a blow, and they render the tube very difficult to keep clean, besides generally entailing some trouble in replacing or packing them.

For locomotives, marine and traction engines, we strongly recommend the use of two glass gauges; the second to replace the ordinary almost useless gauge-cocks. The first guage should be short, and fitted as we have already proposed; the second, fitted in the usual way, should be of very considerable length, say twenty to thirty inches, with a mark about the middle to show the exact top of the fire-box; in many cases the engineer may get his water short—quite out of the ordinary glass in fact—yet it may be very inconvenient, if not impossible, to stop and draw the fire, and he, depending on the fact that his gauge always so fitted as to just empty when there is still an inch or two of water on the top of his box, may go on until irreparable mischief is done. The second gauge would show exactly how far he might go in such a case with safety. On the other hand, by reaching to the top of the boiler it would show, if his ordinary glass were full to the top, exactly how much steam space he had left. The second glass, too, will prevent the necessity for the replacement of a burst glass until a convenient opportunity, and as both are very unlikely to get stopped up at the same time, will prevent such a mistake as a full glass with an empty boiler—a matter of very common occurrence. The additional expense will be very little, compared with the security and comfort of such an arrangement.

COMPOUND ENGINES.

The use of two cylinders, as a means of uniting the full economical advantages due to complete expansion, with the practical requirement of equable motion, seems to be attracting great attention amongst the engineers of the day. This was evinced in the Western Annexe of the Exhibition. In the engines shown by Mr.

Humphreys, similar to those working in the "Mooltan," the small cylinder was erected on the top of the large one, while the same piston-rod was used for both. Another marine-engine, sent from Sweden, had the small cylinder placed within the large one, and was made with three piston-rods, the high-pressure steam being admitted into the inner cylinder and allowed to expand in the outer. A 40-horse power horizontal compound engine was also exhibited by Messrs. Walter May and Co., of Birmingham. The two cylinders had their cranks at right angles, and the steam was expanded out of the small cylinder into the large one. A steam reservoir is required in this arrangement, as when at the end of the stroke of the small cylinder the crank of the large cylinder is at half stroke, and it is therefore so placed that the large cylinder cannot take steam. The steam reservoir was of wrought iron, and it was jacketted by high-pressure steam from the boiler. Mr. Wenham exhibited a very roughly got-up portable engine, also with two cylinders, and cranks working at right angles to each other. The exhaust steam was passed through a heated chamber, and was thus superheated on its passage from the smaller to the larger cylinder. The steam is thereby supplied with heat while expanding during the intermediate stage between the two cylinders. This seems a great step in advance of the use of merely a steam jacket for the reservoir.

Two valuable Papers were consecutively read last year before the Institution of Mechanical Engineers on Double Cylinder Expansive Engines. The first Paper was by Mr. William Pole, of London, favourably known to engineers by an esteemed work on the Cornish engine. Mr. Pole alluded to the use of two cylinders for pumping engines, and particularly in reference to the application of this arrangement to the engines erected by Messrs. Simpson at Lambeth Water Works, Thames Ditton. Mr. David Thomson, of London, in the second Paper, gave a full account of the construction and performance of these particular engines.

The double cylinder expansive steam engine is generally known under the name of "Woolf's engine," and this designation is more especially in vogue amongst Continental engineers. The first employment, however, of two steam cylinders, allowing the steam after it had acted in the first cylinder to be used a second time in the other, is undoubtedly due to Jonathan Hornblower. It is stated that the idea occurred to him in the year 1776; Hornblower patented his invention in 1781. In the specification he states:—"I employ the steam after it has acted in the first vessel to operate a second time in the other, by permitting it to expand itself, which I do by connecting the two vessels together." Hornblower thus *published* the invention some time before Watt; but the latter had previously applied the principle of expansion to single cylinder engines. Watt was, no doubt, aware that the full benefits of expansion could never be attained without the use of high pressures of steam; but he also knew that, in the then state of the mechanical arts, the employment of high pressures would be both difficult and dangerous. Besides, as regards the application of the double cylinder expansive engine for draining the Cornish mines, experience has proved that Watt was sound in his views in adopting the single cylinder. Both Hornblower and Woolf failed in generally introducing the double cylinder engine for the purposes to which pumping engines are generally applied in Cornwall. In any case, Hornblower's engine could not work well without using Watt's separate condenser; and Messrs. Boulton and Watt having gained an action at law against Hornblower for infringing their patent of 1769, the latter was reduced to poverty, and his double cylinder engine fell into abeyance. Having attempted to pirate another man's inventions, Hornblower was long denied what was really his own, and thus, at the revival of the double cylinder engine by Woolf in 1804, it went by the name of the latter engineer. Arthur Woolf, however, merely applied high-pressure steam to Hornblower's engine, and made it double-acting in order to obtain a rotary motion.

The above mainly refers to the use of the double cylinder engine in Cornwall, for pumping water; but a somewhat parallel case, on a smaller scale, is to be found in the history of the use of the double cylinder engine in the northern districts. This class of engine has been long technically known in Lancashire under the generic term of "compound engine;" an expression superior, in our opinion, and less liable to be misunderstood than that of "double cylinder engine." In 1800, Messrs. James and John Roberton, of Glasgow, patented a plan of using the steam on the same principle as that of Hornblower, but instead of placing the cylinders side by side, the high-pressure cylinder was placed at one end of the beam, and the low-pressure cylinder at the other end. In 1845, Mr. William McNaught, of Glasgow, patented the same thing for beam engines; but in order to adapt it to old engines already in use, the new high-pressure cylinder was, according to his plan, placed midway between the centre of the beam and the crank; the stroke of the high-pressure piston being thus half that of the condensing cylinder. What somewhat facilitated the introduction of this class of engine, was the want, often felt in the manufacturing districts, of increasing the mill power without much additional expenditure. An old engine, with an additional cylinder thus placed, is (or was) said, in Lancashire, to be "McNaughted." Several other patented plans have been brought forward at different times to relieve overloaded engines, without renewing the entire apparatus. One plan consists in applying an oscillating cylinder to the old crank shaft. Messrs. Musgrave, of Bolton-le-Moors, obtained a patent in 1855 for the application of a second condensing cylinder to an already existing beam engine. Both the cylinders are worked with one condenser and one air-pump.

Of course there is no theoretical gain in the use of two cylinders. The economical advantage of expansion is the same, whether developed in a single cylinder or a double cylinder engine. When, however, expansion is carried to any great extent in a single cylinder, there is a great irregularity of pressure at different parts of the stroke. The initial pressure at the beginning of every stroke produces violent concussions through the whole of the machinery, and in proportion to the degree of expansion used, the evil will increase. In the ordinary cases, where large pumping engines are used, uniformity of motion is not required; and, besides, with a single cylinder pumping engine, without a crank and fly-wheel, the initial blow is at once absorbed by the inertia of the mass. The ordinary Cornish engine is generally made with a single cylinder working a loaded plunger; because in simply raising water from a deep pit no great regularity of motion is required, the rods have plenty of time to come to rest, and the work is not subject to fluctuations. The case is, however, different when the water has to be pumped direct into a town or into a remote reservoir. The water is necessarily taken off from the mains at irregular intervals, producing considerable variation in the pressure. As Mr. Hawksley stated, in the discussion that ensued upon the two Papers we have alluded to, and in reference to engineering practice in water works: "It is found useful in these cases to apply a fly-wheel, and it was also desirable to carry out the expansion to a considerable extent, as the steam could in practice be expanded further when a fly-wheel was used than in the Cornish engine without a fly-wheel. It therefore became a consideration how best to get this increased amount of expansion; and the double cylinder engine was found to afford the means of so limiting the initial blow of the steam that practically there was no necessity for employing a great weight of material to obtain the requisite strength in the engine, since the strain on all the machinery could be reduced to a minimum for a given power, by properly adjusting the proportions of the two cylinders, and cutting off at the proper point of the stroke in the small cylinder."

In the larger classes of engines, with reciprocating parts of a necessarily heavy character, the advantage of using two cylinders makes itself peculiarly felt, as equability of motions is a *sine quâ non* for the permanent stability of such heavy machinery. Even with Cornish pumping engines, when high pressures of steam are used, there is a necessity for diminishing the risk of fracture from the initial blow of the entering steam, by the use of double cylinder engines. Mr. Sims, of Redruth, in Cornwall, first contrived the simple plan of double cylinder engine for this purpose, in which the small cylinder stands on the top of the larger one, and the same piston-rod is used for both cylinders. The number of valves is also the same as in the common pumping engine.

When it is wished to obtain a high degree of expansion in marine and other rotary engines, with a single cylinder, the amount is limited to an extent of three or four times, from the great strain at the commencement of the stroke, compared with the mean force of the entire stroke. In these engines the initial blow is not absorbed by the inertia of a large mass to be put in motion at the beginning of the stroke, forming a reservoir of power for the steam while expanding through the remainder of the travel of the piston. Compounded engines are, in this case, peculiarly advantageous, as is instanced by the success of the engines on this plan, built by Mr. Humphreys, for the "Mooltan" and other vessels. Of course steam-engine economy almost always involves additional weight and expense in the engine. This is, however, in this case, compensated by the reduced number of boilers and furnaces required in developing a given amount of power—a fact which is not seldom lost sight of when estimating the relative advantages of compounded and single-cylinder engines.

The pumping engines for the Lambeth Water Works Company, described in the Papers of Messrs. Pole and Thomson, required great equability of motion, and a complete avoidance of all concussions and irregularities of pressure, as the water had to be forced along a cast-iron main, nine miles long, and 30 in. diameter. From the large amount of steam power required, great economy of fuel was also necessary. For these reasons, the engines described in Mr. David Thomson's Paper were erected. They are beam engines, with double cylinders, with cranks and connecting rods. "Four engines of 150-horse power are fixed side by side, arranged in two pairs, each pair working on to one shaft, with cranks at right-angles, and a fly-wheel between them." The strokes of the crank and of the large cylinder are the same. The smaller cylinder has a shorter stroke, and its effective capacity is almost one-fourth of that of the large cylinder. The principal peculiarity in the engines consists in the steam being cut off in the *small* cylinder before the end of the stroke, and the expansion is then allowed to proceed from that point, and according to an analytical investigation given by Mr. Pole in an appendix to his Paper, the most advantageous point of the stroke for cutting off varies in the small cylinder with the extent of expansion adopted in the engine.

The main objection to the compound engine consists in its additional complication and weight. This is, however, as we remarked above, generally compensated by a reduction in the number of boilers and furnaces required. The plan of compounding engines has been often very injudiciously carried out in Lancashire; and arrangements have been adopted evincing disgraceful ignorance of the requirements of the case. As Mr. Pole stated, "There is a peculiarity in the double cylinder engine in its requiring a pipe or passage of some kind through which the steam must travel from one end of the small cylinder to the opposite end of the large one; and this passage should evidently be as small in content as possible, consistently with allowing the free passage of the steam. When the communication is opened at the end of the stroke, the steam passing from the small cylinder has to expand and fill this passage before it enters the large cylinder; and, if the passage be large, the steam must necessarily suffer a reduction of pressure in so doing, which must seriously diminish its effective action on the large piston during the future stroke, and so cause much loss." In some engines Mr. Pole found this loss so great as to waste nearly half the power of the engine; and, even in the best that were examined, such a considerable percentage of loss occurred as almost to neutralize the benefit of expansion altogether. Mr. Scott Russell, in the discussion that followed the reading of the Papers, stated that, in order to get over the difficulty of repairs, arising from the complexity of the double cylinder engine, he had arranged an engine with three independent cylinders; and each cylinder expanded the steam about four times, and they all worked direct on one crank. Mr. Scott Russell said that the consumption of coal with this engine was as low as 2½ lb., and even 2 lb., per horse power per hour. This arrangement, of course, increases the number of the parts; but, at the same time, they are all easy of access, and the engine, as a whole, could not be easily disabled for work.

Every arrangement in engineering, like almost every course in life, has its own peculiar merits and demerits; and each special problem has its own peculiar difficulties and facilities. The art of the expert engineer is shown in his skilful adaptation of any special arrangement with its attendant advantages and disadvantages to the peculiar exigencies of any given case.

COLLIERY LOCOMOTIVES.

Not the least item of expense connected with the working of a coal, or indeed any other mine, is the conveyance of its produce to the place where it becomes useful. The sinking of shafts, the erection of pumping and winding machinery, nay, the very raising of the coal, or ore, to the surface—operations attended as they are with risk and expense in no slight degree—are, after all, in most cases, but preliminary operations, which require the addition of a means of transit, safe, expeditious, and economical, before the miner can hope to reap any return for his labour, capital, and skill. The railway station or the wharf is usually at a considerable distance from the pit's mouth. Blast furnaces, although at first erected as close as possible to the mine, in the course of a few years, or even months, exhaust the veins in their immediate neighbourhood, rendering the sinking of new shafts at greater distances a matter of necessity, hence the transfer of materials to supply them becomes a matter of serious importance to their proprietors.

In the mining districts generally we see lines of railway, or tramway rather, laid down from the pit's mouth to the wharf, the railway station, or the blast furnace, on which waggons capable of holding from a ton and a half to three tons, or even more, are drawn in trains of two or more by teams of horses. These railways are for the most part of the rudest construction. The sharpest curves and steepest inclines are considered matters of little importance; contractors' rails worn to the last, and, when new, of all patterns, spiked in the most negligent fashion to sleepers, which are seldom replaced so long as a rail can rest on, without actually going through them, from the permanent way. Scarcely an attempt is made to keep the joints good, or the rails of an equal height; when, in addition, we remember that the gauge seldom exceeds 2 ft. 6 in.—3 ft. being unusual, and 4 ft. seldom or never met with—we are very liable to draw the conclusion that a more unpromising road to work with locomotives cannot possibly be met with, even in the wilds of America.

On much such a road, nevertheless, did steam, in the hands of George Stephenson, commence that great era of locomotion which is the distinguishing characteristic of the 19th century; but, although railways spread in all directions around us, the modern engineer, discouraged by the unpromising field, has failed to introduce the locomotive to any great extent, as a substitute for horse labour, on such lines as George Stephenson had to deal with. Colliery proprietors and ironmasters, believing it impossible to work locomotives successfully under the circumstances, prefer to employ expensive horse-labour, contending, that any advantage to be derived from the employment of an engine, would not compensate for the large outlay necessary to improve their roads to such an extent as they believe requisite to ensure the working of a locomotive with success. In many cases, too, the purchase of land necessary to straighten a line, would entail an enormous expense; besides, rival proprietors' lines often cross one another, so that raising one might cause such an incline on another as to render it useless; all these things considered, we see apparently good reason why horse labour is still adhered to.

Now, we believe that the conclusions which have led to this result, have been arrived at too hastily, and without sufficient reflection—without, in short, a sufficiently careful examination into what the qualifications of the locomotive for such situations actually are. An acquaintance with it only when drawing heavy passenger trains, at a lightning speed on a line so perfect that the first-class passenger may imagine himself passing over velvet, gives but little idea of the actual capabilities of suitable engines even on the worst roads, and under the most difficult circumstances. If carriages propelled by steam can proceed with ease, safety, and expedition, not only on common roads, but even down, aye, and up, our green English lands, how much more likely are they to succeed on a road into which at least they cannot sink? a road indeed, which, with all its imperfections, will permit a horse to draw at least twice as much as he can on the best turnpike. The construction of engines which will do good service in those cases, is not a problem which presents as many difficulties as we may imagine at a first glance. At a low speed, carriages, whether drawn by horses or propelled by steam, may proceed over even the worst track with comparative ease; and, we feel certain, that light locomotives with low wheels, and a very short wheel-base, may be worked with success on almost any of the lines now worked by horse-power. The loads to be drawn need, in no case, exceed 60 tons, or the pace 7 or 8 miles an hour—5 will usually be found quite fast enough for all ordinary requirements; and as the existing waggons, which will in most cases have to be returned in active service, seldom extend 20 in. in height from the rail to the side beams, no possible advantage can be gained by placing the engine on high wheels, which entail a great deal of trouble in the attempt to keep the buffer-beam low enough to suit the waggons. A low wheel, too, ensures a good blast in the chimney, by enabling the pistons to make a fair number of strokes in a minute. We believe that 2 ft. 6 in. will be found a good general diameter. As to material, nothing can be better than cast iron, with steel tyres. The rails are in general covered with so much dirt and grit, owing to their small elevation above the surface of the ground, that wrought iron suffers rapid wear. Steel tyres appear to deserve the high character they bear, for such purposes at least.

Too much care cannot be taken to make the bearing of such engines stiff, as outside cylinders must be adopted, and these, of considerable diameter and at some distance from the frame, exert a powerful tendency to bend it; and, the imperfections of the road added to this, would quickly pull everything to pieces were not strong cross braces and plates introduced between the frames. For this reason, as well as another which we will refer to further on, the best practice would be to adopt some such arrangement as Forester used in his first engines—that is, to place the valve chests outside of the frame on top of the cylinders, working the valves by means of a suitable rocking shaft. Although the engines first constructed on this principle gained the name of "Boxers," from their oscillation at high speeds, no objection can apply to them when running at speeds under ten miles an hour; and it was not the arrangement of the valve chests, but of the cranks, whch caused them to fall into disfavour with engineers. When we remember that the space between the frames of an engine for a 2 ft. 6in. gauge is but 20 in., when the frame is, as it should be, inside the wheels, we at once see the great advantage gained by the adoption of any arrangement which leaves that space in occupied machinery, and permits the introduction of strong plates between the frame to impart the necessary stiffness.

As the wheel-base is generally very limited, owing to the unusually sharp curves generally met with on colliery railroads, the distribution of weight becomes a very important consideration. As but four wheels are admissible, and they of course coupled, means must be adopted to secure sufficient weight on the leading pair for the purposes of adhesion, as well as the preservation of the permanent way, which, being weak, is quickly destroyed by overloading a single pair of wheels. This same distribution of weight is a very troublesome problem, from the fact that the fire-box being wider than the gauge of the line by many inches cannot go between the wheels, and, united to the weight of the foot plate, which must be of some size, to carry coals, far overbalancing the cylinder end of the engine; the light smoke-box proving no match for the heavy fire-box. We have seen it necessary to resort to a cast-iron buffer-beam in front, ere now, to get over the difficulty.

A proper disposition of the centre of gravity may always be secured by placing the water tank between the frames under the front end of the engine, and fixing a large steam dome on the top of the boiler, as close as possible to the chimney. Where a wheel-base of 5 ft. or 6 ft. can be secured, this will invariably give a steady engine, although it may overhang the wheels as much as 5 ft. or 6 ft. at each end; and, in order to obtain space for a water tank in the situation named, it is evident that all the working machinery must be outside, with the exception of the link motion and eccentrics. Another advantage in placing the valve chest outside will be found in the ease with which steam-tight joints may be made and broken when easy of access, which they cannot be within the smoke-box or under an engine at once so low and narrow. The constant jolting, too, to which the engine is exposed is very apt to break the steam-pipe joints, unless some elastic arrangement is adopted.

Ample cylinder room should be provided, to meet the exigencies of an undulating road; it is of little consequence if the boiler is unable to furnish full pressure steam to the cylinder for long periods together; they will seldom exert a constant drain on the boiler, and, besides securing economy (not, indeed, that that is of much importance in a coal district) by working in general on a high grade of expansion, will, with 100 lb. steam, give ample power for any possible exertion the engine may be called on to make in ascending a steep part of the road, &c. We know many lines, which in general tolerably level, have one or two inclines of perhaps 1 in 30 or 1 in 40, a hundred yards long, or so. Over such inclines the train, from its slow speed, possesses no impetus to aid the engine—as the drivers say, "It is all dead pull." Large cylinders prevent any difficulty in such cases.

Where machinery is already so much cramped for room, it is almost needless to say that a pump is inapplicable. A No. 5 Giffard Injector is superior in every respect; room is easily found for it on the foot-plate.

Horses cannot compete in economy with light locomotives such as we speak of. The cost of fuel is almost nominal; and although we do not for a moment advocate bad roads, still we do not hesitate to say that in few cases need we be deterred by their imperfect condition from employing a locomotive suitable to their requirements. Money will be expended to advantage in improving such lines; this being done by degrees, may often be effected almost insensibly; every such improvement will well repay the outlay, by adding to the durability of the engine and reducing wear and tear.

Everything which tends to cheapen produce confers a benefit on the consumer. The public generally are large consumers both of coal and iron, and we believe the introduction of light locomotives on colliery railroads a matter of some interest to the community at large.

A plan has been prepared by Mr. Thomson, of Glasgow, architect, for the extension of the line of Ingram-street, in that City, to the High-street front of the University.

NAVAL ARMOUR EXPERIMENTS AT SHOEBURYNESS.

[From our special Reporter.]

THE experiments on iron-clad targets in progress at Shoeburyness derive a special interest from the fact that their object is to test the value of systems of backing to armour plates which have not yet been tried. In the construction of our mailed ships of war, whether of iron or wood, the plates without any exception are backed with teak. The "Warrior" plan—4½ inch plates on 18 inches teak—has been the type, which, however, is modified in the "Minotaur" class, by increasing the thickness of the plates to 5½ inches, and reducing that of the teak to 10 inches. No iron-clad has been constructed or designed up to the present time with any other kind of backing to the armour but wood. Two years ago the Iron Plate Committee, as well as several shipbuilders, doubted the efficiency of wood as backing. The idea of incorporating the weight of the teak in the armour, or in the structure of the ship, prevailed, and the Admiralty had targets constructed on that principle on plans proposed by Mr. Fairbairn, Mr. Samuda, and Mr. Scott Russell. These were experimented upon, and proved less efficient than the "Warrior" system. But in all these cases, there was in fact no backing. The armour plates were bedded on a frame representing the hull of an iron ship.

A system of iron cells or girders, in lieu of wood, as backing to the armour plates, with perfect rigidity of fastening, has been for some time under consideration. Being recommended for trial by the committee, the Admiralty ordered a target on that plan to be constructed, and it will, when completed, be submitted to the usual tests at Shoeburyness. In the meantime, Mr. J. Chalmers, C.E., the projector of a submarine railway between Dover and Calais, of which the drawings were exhibited at the International Exhibition, in connection with Sir Morton Peto, M.P., who is a partner in the Millwall Shipbuilding Company (late Messrs. C. J. Mare and Co.), had a target constructed which partially adopts the iron cellular backing principle, but without rigidity. This is the target experimented upon on Monday last, under the direction of the Special Committee on Iron, and is thus described in their programme: "The target proposed by Mr. Chalmers to test his plan of armour plating, and constructed by the Millwall Iron Works (13 ft. 4 in. long, and 10 ft. high), is composed of three 3½-inch armour plates, backed by alternate layers of timber and iron; and then there is a second armour plate 1½ inch thick, with a cushion of timber between it and the skin of the ship, the fastening bolts have stepped conical necks and a square thread. The trial to consist of the following rounds—Nos. 1, 2, 3, 110-pounder rifled gun, 12 lb. charge, shell filled with sand 104 lb. weight. Nos. 4 and 5, 68-pounder smooth-bore gun, 16 lb. charge, shell filled with sand 40½ lb. weight. Nos. 6, 7, 8, 9, 10, live shell with the same guns and charges. Nos. 11, 12, 13, 110-pounder rifled gun, 14 lb. charge, solid 110 lb. cast-iron shot. No. 14, 68-pounder smooth-bore gun, 16 lb. charge, solid cast-iron shot 66½ lb. Nos. 15, 16, 17, 110-pounder rifled gun, 10 lb. charge, solid 200 lb. cast-iron shot. Nos. 18, 19, 20, three 200 lb. solid cast-iron shot in salvo. No. 21, 68-pounder, 16 lb. charge, solid cast-iron 66½ lb. shot. Nos. 22, 23, 24, 110-pounder rifled gun, 14 lb. charge, and Nos. 25, 26, 68-pounder smooth-bore, 16 lb. charge, to be fired in salvo with solid cast-iron shot. No. 27, 110-pounder rifled gun, 16 lb. charge, steel jacket shot, flat ended, 109 lb. weight. The above trial is similar to the first day's experiments on the original "Warrior" target, with the exception that no experimental guns are used in the present trial."

To understand the system of the target, some explanation is required.* The "layers of timber and iron" are teak planks 11 in. wide and 4½ in. thick, and iron plates of the same width ½ of an inch thick, laid horizontally, and alternately one upon another. They abut behind against the 1½ in. plate. Vertically they are held together by 1 in. iron rods, 10 ft. long, with screw ends and nuts, holes being drilled through these planks and plates for the passage of the iron rods. Some bolts are passed horizontally through some of the planks, and screw up inside the skin. But in this arrangement there is an obvious want of cohesion, which the inventor compensated by an abundant appliance of caulking, red lead and marine glue. The backing, as well as the armour plates, in fact, rely mainly upon the through bolt fastenings with "stepped conical necks" for adhesion to the structure they are intended to protect. The bolt heads are supported with heavy iron washers, fixed immediately at the back of the bolt holes of the armour plates. The main feature of the plan is the wooden cushion interposed between the backing and the skin of the ship. It is meant to act as a buffer, yielding to the blow, and tending to diminish recoil. This effect being realized would, however, counteract rigidity. The results will show how far the expectations formed have been realized.

In accordance with the programme and previous target trials, the experiments commenced with three 110-pounder, and two 68-pounder shells filled with sand, followed by the same number and description of live shells, each one fired singly. The object of this practice is to test the effect of vibration on the plates and structure generally, but especially on the fastenings. The indentations from the 110-pounder elongated rifled shells were from ½ to 1 in., and from the spherical 68-pounders about 1½ in. in depth. Two plates were driven in ½ to 1½ in. at the edges where the shells struck, and exhibited rather extensive cracks in various directions, running from the bolt holes—some concentric at the points of impact, some horizontal, and some angular. These cracks, which were more numerous than those on the "Warrior" section with the same shell practice, are, no doubt, to be attributed to the heavy iron washers, introduced at the back of the plates under the heads of the bolts, acting as bearing points at the bolt holes, so that instead of affording support, they become sources of weakness. The bolts themselves suffered no damage, not a nut or washer was in the least displaced; the ship's frame sustained no injury, except 10 or 12 small rivet heads chipped off. No. 11, a solid 110-pounder rifled shot struck the top plate at the left end, buckled it longitudinally 3 in., and made an indent 6·7 in. by 1·2 in., caused a deep crack across the indent, and separated the plate 3 in. from the backing at the top. Nos. 12 and 13, solid 110-pounders, produced nearly similar effects on the middle and bottom plates. No. 14, a solid 68-pounder, made an indentation 2¼ in. deep by 8½ in. at the right end of the middle plate, and slightly cracked it. Still, from these four solid shot, the bolts showed no sign of damage. Inside the skin, 7 or 8 more small rivet heads came off. No. 15, 16, 17, three 200 lb. shot with 10 lb. charge, fired singly, produced indents of less than an inch in depth, broke off two small backing bolt nuts, and cracked a plate slightly at the impact. Nos. 18, 19, 20, a salvo of 200 lb. solid shot, fired with 10 lb. charge from 110-pounder guns, at the centre of the middle plate, did no damage to the plate beyond a few slight cracks from bolt holes; but four of the frames were bowed inwards by the heavy weight of metal—two about 1½ in. from the perpendicular, and two slightly, but without any fracture. The armour bolts again remained unhurt, although one was struck on the head. These heavy projectiles, however, with small charges and at low velocities are usually not very damaging. No. 21 was a miss. Nos. 22, 23, 24, three 110-pounders, and Nos. 25, 26, two 68-pounders fired together in salvo against the right end of the top plate, were the trying and final test of the programme. The target passed through this ordeal triumphantly. There was the usual indentation from the shots individually, and several cracks over the area of impact, but the smashing effect was less than from similar salvos fired at other targets on previous occasions. The plate buckled outwards at the end about 3 in., the frames inside and the skin were curved full 2 in., and one bolt which was struck on the head was broken in two in the shaft and the end-piece driven through.

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* An illustrated description of Chalmers' target will be found on page 324.

The trial of this target must be regarded as a remarkable success. It stood the brunt of the firing throughout better than the "Warrior" target. In the crowning test—the salvo of 5 great guns, concentrating 466 lb. weight of metal, at a high velocity against one plate over an area of about 2 ft. square—it carried away the palm. A similar salvo, fired at the "Warrior" section, fractured and buckled the plates more extensively, and broke or loosened six or seven bolts.

The success so far obtained is to be ascribed to the cellular iron-backing, on which the plates are bedded, and no doubt would have been more decided, if the principle of rigidity had been entirely adhered to. The indentation and cracks in the plates would probably have been less, if the wooden cushion and its supporting frames behind the cellular backing, which Mr. Chalmers stated to be the main feature of the plan, had been omitted from the structure. He openly acknowledged his error, and regretted that he had not used the misapplied weight of the cushion to increase the thickness of the armour plates.

In comparing this with the "Warrior" target, it must be borne in mind, that the plates of the former are only 3¾ in., whilst the latter are 4½ in. thick. On the other hand, it must be conceded, that the total weight of materials in the Chalmers structure, exceeds that of the "Warrior" section by 50lb. per square foot, a difference which not only ought to give greater strength, but is an element of importance in respect of the carrying capacity of a ship. For the armoured area of a "Warrior," the additional burden would be about 250 tons. If that weight, equal to 1¼ in. of iron all over, were added to the thickness of the "Warrior" plates, increasing it from 4½ to 5¾ in., their resisting force would be greatly augmented.

This experiment is a practical demonstration on a large scale, of the superiority of rigid, to elastic or yielding backing, of which smaller experiments of the Iron Plate Committee afforded indications two years ago. It may be hoped that the Admiralty will at length learn to believe that the "Warrior" system of armour-plating is not perfection.

Up to this point, which concluded the ordinary test experiments with 110 and 68-pounder guns, no projectile was fired with a force sufficient to penetrate the outer armour plates. The trial so far established the fact that a 3¾ in. plate on a rigid backing has greater force of resistance than a 4½ or 5½ in. plate on wood backing. In this case, it better protected the plates from indentation or buckling, and better protected the fastenings. Practically, it resisted penetration more effectually. But the strength of this peculiar system of constructing cellular backing, to resist smashing effect, was not put to the proof by any of the projectiles hitherto fired. This ordeal was reserved for the last round, No. 27. It consisted of a 300-pounder solid steel shot, fired with a charge of 45 lbs. This formidable missile made a clean breach through and through the target. Having penetrated the armour plate, of which it cut out a piece about 12 in. in diameter, and carried it off bodily on the face of the shot, it met with no resistance from the 4½ in. teak planks an ¾ in. iron plates, which were pounded into small splinters and minute particles. It crushed through the iron skin and frames, forming an aperture in the hull of the ship 18 in. by 2 ft. The shot was then brought up by an old Hawkshaw iron target, which served as a back support, and, although 9 in. thick, was burst open by the spent force.

In former trials of smashing effect with a 300-pounder steel shot and 45 lb. charge on other targets, not exceeding this in weight, the effects were by no means so destructive. The projectile encountered greater resistance. The difference may be accounted for by the want of cohesive strength, before alluded to, in the mode of building up the backing by alternate layers of teak planks and thin iron plates packed horizontally one upon the other, and tied together with vertical rods, for the passage of which numerous holes are perforated through the planks and plates.

This appears to be a defect in the mode of construction which, no doubt, can be remedied. In the meantime, probably, the value of rigid backing to prevent buckling and protect bolts is established by these interesting experiments.

TWIN SCREW STEAMERS.

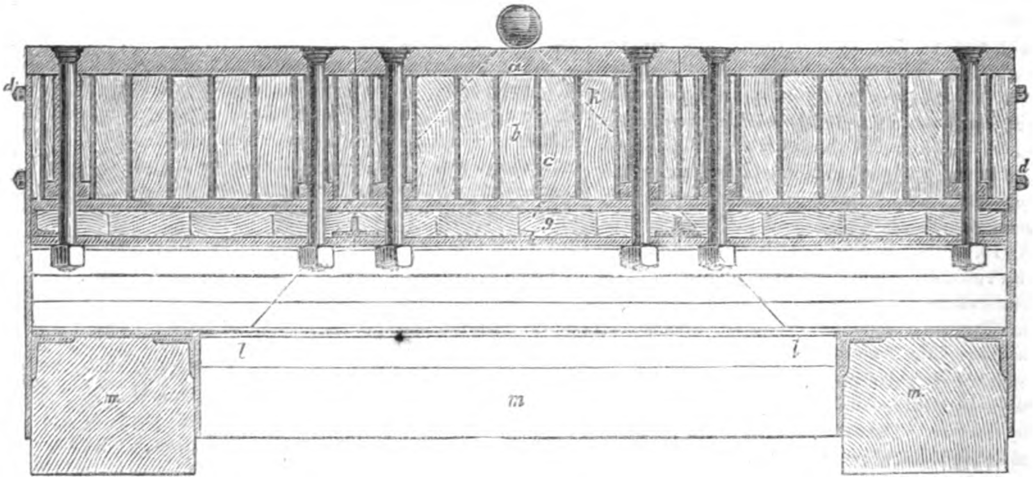
We have several times recently called attention to the plan of building twin screw steamers as patented by Mr. Richard Roberts, advocated by Commander Symonds, and practically tested by the Messrs Dudgeon, of the Isle of Dogs. The subject is an important one, and we are glad to find that it is securing the consideration of scientific men. On Wednesday last week, Commander Symonds read a Paper on the subject before the Society of Arts, and on Saturday last the Messrs. Dudgeon made a trial with the "Hebe" between the Nore and Mouse lightships.

Commander Symonds, in his Paper, said:—Notwithstanding the marked improvement that had taken place in shipbuilding during the last quarter of a century, we did not appear to have made that progress in the application of the screw as a propeller which might have been anticipated; nor had we improved the manœuvring and steering qualities of our ships in the slightest degree, although the necessity for this has increased with the larger dimensions on which they are now constructed. It had been, as the author thought, unwisely recommended to increase the area of the rudder considerably, and apply steam or hydraulic power to actuate it, thus effecting by overwhelming force that which might be attained by turning the propelling power to account as a steering agent. He believed we had arrived at a point beyond which it would be unsafe to increase the size of the rudder. He pointed out various objections that he conceived to exist in the ordinary single screw system. Amongst these might be mentioned the enormous and costly forgings required for stern-posts, and other difficulties of construction, the exposed position of the ordinary screw and its liability to fouling, as well as the fact that, being in the centre of the iron, it works in the centre of the disturbed water or eddy caused by the passage of ships, and, being so near the surface, is constantly lifted out of the water, which involves loss of power, and causes vibration by the unequal action of the upper and lower blade. The invention of the twin or double screw was due to Captain Carpenter, R.N. In this instance, and until a date subsequent to Mr. Roberts's invention, the two screws were driven by the same engine, and therefore could not be used independently, the leading and most valuable feature of the principle being entirely overlooked. This Mr. Roberts supplied by the application of separate engines to each shaft, by which the screws are driven independently of each other, and a perfect steering power is obtained. By reversing the action of one screw the ship is turned round on her centre, as upon a pivot. Commander Symonds mentioned several vessels in America, as well as in this country, particularly the "Flora" and "Kate," that had been fitted on this system, and adduced instances in which they had displayed remarkable powers of manœuvring. He described in detail the particular mode of construction which he recommended, and said that he had made most important improvements since the two vessels above mentioned were constructed. He pointed out the great advantages, particularly in warlike operations, that his system afforded, and he thought that from whatever point of view it might be regarded, whether as a power of propelling, steering, or manœuvring our otherwise unmanageable war ships, either engaged at sea or with forts in narrow waters, or whether as applied to ships of commerce, where light draught and handiness are equally essential, the question assumed a magnitude and importance that demanded the greatest consideration and the most ample experiment.

The trial which took place on Saturday last was the third of the kind which the Messrs. Dudgeon, had made.

The performances of the first two—the "Flora" and the "Kate"—have been already noticed, and the advantages of the system over that of the single screw were again strikingly manifested during a series of manœuvres which were made after the trial of speed between the lightships. The "Hebe" is an iron vessel, of 470 tons, 165 ft. long, 22 ft. 6 in. beam, 13 ft. 6 in. deep, having a deck house, 7 ft. high, extending about three-fourths of her length, fitted up with cabin and saloons. Draught of water at time of trial, 5 ft. forward and 9 ft. aft. Being without dead weight to give her sufficient immersion, the vessel was under considerable disadvantages, especially as there was a strong wind blowing, which materially retarded those evolutions which formed the principal feature of interest to most present. The screws were three-bladed, 7 ft. 6 in. in diameter, with 15 ft. pitch, worked by two separate and independent engines, having two cylinders 26 in. in diameter, with 21-in. stroke of pistons, and 120 collective nominal horse power. The revolutions at the time of trial between the lightships were 110. The time occupied between the Mouse and Nore light-ships was 33 min. 15 sec., the distance being eight statute miles. Among the evolutions performed for the satisfaction of the scientific gentlemen present were the following:—1. Full speed ahead with both screws, helm hard a starboard; circle complete in 4 min. 2. Full speed ahead, both screws, helm hard aport; 3 min. 40 sec. 3. Helm a starboard, with port screw stopped; circle completed in 3 min. 9 sec. 4. Circle made the reverse way by putting the helm aport and with starboard screw stopped, in 3 min. 38 sec. 5. Helm hard aport, the screws being turned in opposite directions, the vessel pivotted on her centre in 3 min. 52 sec. 6. A second experiment the reverse way was made in 4 min. 10 sec.; the mean time of these last two revolutions being 4 min. 1 sec. 7. Helm amidship, the screws working in opposite directions; the circle was completed in 4 min. 58 sec. The engines varied alternately in these trials from 90 to 103 revolutions per minute. As before mentioned, during these experiments a fresh wind prevailed, which materially retarded the turning, the vessel being light, and consequently exposing a large area to the wind. The engines worked admirably throughout, the boilers giving an abundance of steam, and the whole of the arrangements were excellent, reflecting great credit on the builders. Among the numerous scientific gentlemen present were Sir J. D. Elphinstone, M.P., Admiral Sir Edward Belcher, C.B., Sir J. Lawrence, Captains Jones and Howes, R.N., Commander T. E. Symonds, R.N., Colonel Paradis, (Imperial Austrian Service), Messrs. W. Ellice, E. Gellatly, F. Sewell, Abbots, Dunbar, O. Dingler, Imperial Austrian Service, W. Smith, C.E., Zerah Colburn, C.E., Kitson, C.E., and others connected with the mercantile marine.

THE CHALMERS' TARGET.



THE CHALMERS' TARGET.

This target, which proved such a signal success at Shoeburyness, on Monday last, represents a section of an iron-plated ship, 13 ft. 4 in. by 10 ft. The accompanying cut is a vertical section of the target, from which it will be seen that its chief distinctive features are—first, the backing to the armour plate *a*, composed of alternate layers of timber planking *b*, and iron ribs *c*, which present their edges as a support to the plates, and which are bolted together laterally with the bolts *d*; second, an intermediate or second armour plate *f*, being, as it were, a back, or bottom girder, upon which the inner edges of the backing layers rest; third, a cushion of timber planking *g*, between this second plate and the skin of the ship *h*; fourth, the through fastening-bolt *i* has a stepped conical neck, and a peculiar square thread, the depth of which is only half the pitch. The inventor states that the objects aimed at in these arrangements are to obviate the evils that invariably result from a backing composed of wood only, such as buckling, penetration, &c., and to guard against the equally injurious effects of vibration and distortion, such as the fracturing of the armour plates and the destruction of fastenings and frame of ship, which he contends are inseparably connected with very rigid structures. Mr. Chalmers has long maintained that his plan of construction is calculated to disperse over an extended area the power or work contained in the projectile at the point of impact, for, owing to the great strength of the compound backing *b*, *c*, he argues, that the force will take the direction of the diverging lines *k*, thus giving an area of resistance equal to 25 ft. at the inner line of the ship's frame *l*. The results of the trial on the 27th show how well founded have been his calculations. The importance of the old "Warrior" target as a standard of resistance has passed away, and "The Chalmers' Target," for the present, will be the datum from which to estimate the value of future projects.

COOKE'S IMPROVEMENTS IN BATTENS FOR WEAVING.

FIG. 1

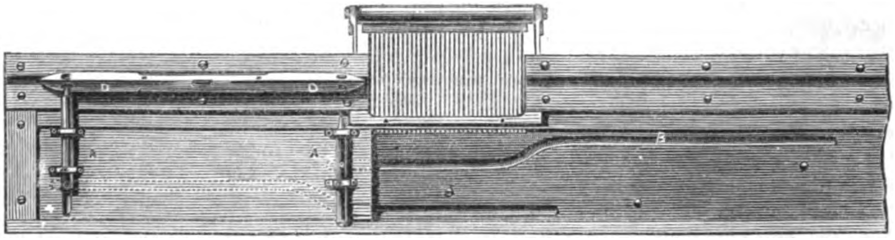


FIG. 2

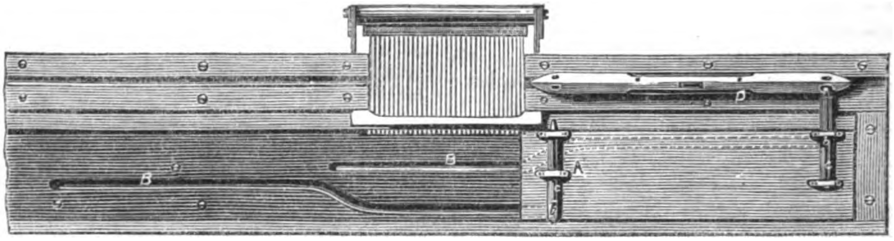


FIG. 3

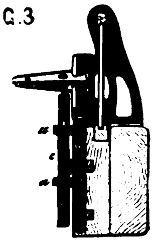
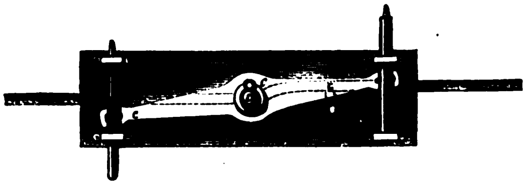


FIG. 4



IMPROVEMENTS IN BATTENS FOR WEAVING.

Mr. J. T. Cooke, of Leicester, has obtained a patent for "improvements in battens for weaving." The invention consists in the employment of one slide bar or carrier, on which are fitted pegs or bolts for carrying the shuttles from side to side of their work, as hereafter described. Fig. 1 of the accompanying engravings is a face view of a batten, constructed according to this invention, showing the shuttle on one side of the race; and fig. 2 is a similar view, showing the shuttle on the other side of the race. On the bed of the batten a slide-bar or carrier A is fitted, which works in grooves B, B, so that it may slide backwards and forwards. On this slide-bar are fitted pegs or bolts C, C, working through eyes *a* to allow the pegs to rise and fall. On each of the pegs C a stud *b* is fitted, as shown in section in fig. 3, which studs pass through the slide-bar A and work in the grooves B, B. The slide-bar A has slots *c* cut therein for the studs *b* on the pegs C to work through; the studs *b* fit and work in the grooves B, B, so that when the slide-bar A is moved to and fro the pegs C receive an up-and-down motion, and take alternately into the holes in the shuttle D, which is thereby carried from side to side of its work.

The motions of the pegs are obtained by means of a balance lever working on an axis fixed on the slide, as shown in fig. 4, which is a face view of the slide-bar. A is the slide-bar; B the groove, of which there is only one in or on the bed of the batten, and of the shape shown; C is the balance lever centered on the axis D fixed in the slide-bar. Slots E, E are formed in the arms of the lever, and these slots receive studs fixed on the pegs F, F. G is a guide-pin fixed in the balance lever, passing through the slide-bar and entering the groove B. On the slide-bar being driven from end to end of the bed of the batten, the lever is caused to rock, and drive the pegs into and out of the holes in the shuttle, and thus carry it through its work.

INSTITUTION OF CIVIL ENGINEERS.

April 28, 1863.

John Hawkshaw, Esq., President, in the Chair.

The Paper read was, "The Charing-cross Bridge," by Mr. Harrison Hayter, M.Inst.C.E.

It was stated that this bridge consisted of nine spans—six of 154 ft. and three of 100 ft.—the centre opening of the Hungerfod Suspension-bridge having been divided into four spans each of 154 ft., and that on the Surrey side into two spans also of 154 ft. each, and the opening on the Middlesex side into three spans, each of 100 ft.—the superstructure over the latter being fan-shaped. The width of the river, at the site of the bridge, was 1,350 ft. The greatest depth of water between the two brick piers of the original bridge was 13 ft. below low-water spring tides, and the average depth was about 9 ft., the the rise of spring tides being 17½ ft. The level of the rails was 31 ft. above Trinity high-water mark, and there was a clear minimum headway under the bridge of 25 ft. above the same datum.

The superstructure was carried by cylinders sunk into the bed of the river, and by the piers and abutments of the suspension-bridge, the abutments having been considerably lengthened. The cylinders, excepting at the fan end, were 14 ft. diameter below the surface of the ground, and 10 ft. diameter above, the junction between the two sizes being effected by a conical length. There were four piers formed of these cylinders, each consisting of two cylinders, 49 ft. 4 in. apart from centre to centre. They were of cast iron, 1⅛ in. in thickness throughout, and the circumference was divided into segments, with interior flanges round all the edges, through which the segments were bolted together; and a horizontal interior rib was also cast in the middle of each segment. There were thus continuous vertical lines of ribs, securing a strong columnar arrangement.

The strata through which the cylinders were sunk consisted of mud and gravel, of varying thicknesses, overlying the London clay. The sinking was effected by excavating the material from the inside—at first by divers, but after the London clay was reached and the water pumped out, in the ordinary way—and by weighting the cylinders, to an average load of 150 tons each. These cylinders were sunk to depths of 52 ft., 62 ft., and in one case 72 ft., below Trinity high-water mark. They were filled with Portland cement concrete up to where the conical length commenced, and above with brickwork, set in Portland cement mortar, to the under side of the granite bearing blocks, which were 2 ft. 6 in. in thickness, and projected 1 in. above the top of the cylinders, in order that the weight might not come on the upper edge of the ironwork. With a view of testing the strength of the foundations, the two cylinders in the pier nearest to the Surrey side, after being completed up to the level of high water and filled with concrete and brickwork, were each weighted with 700 tons, being about equal to the greatest load they could possibly have to sustain, supposing the four lines of rails on the bridge to be loaded with locomotive engines. This caused the cylinders to sink permanently 4 in. To bring the other cylinders to a bearing, so as to prevent any settlement after the completion of the bridge, from the weight of the permanent and moving loads, they were each weighted with 450 tons, when it was found that they permanently sank, on an average, 3 in. each. Each pair of cylinders forming a pier was connected together transversely by a wrought-iron box girder, 4 ft. deep, which also served as a cross-girder for supporting the roadway. Assuming the four lines of way on the bridge to be loaded with locomotive engines, the pressure on the base of the cylinder would amount to eight tons per square foot, and on the brickwork at the top of the cone to about 9 tons per square foot.

The superstructure of each of the 154 ft. openings consisted of two main girders, to the under side of which were suspended cross-girders, for carrying the roadway platform. These cross-girders extended beyond the main girders, and formed a series of cantilevers on the outer sides, for supporting two footpaths, each 7 ft. wide in the clear. The main girders were of wrought iron, and were not continuous, but extended only over one opening. Each girder had to support, inclusive of its own weight, a maximum distributed load of 750 tons. The extreme depth of these girders was 14 ft., and the depth between the centres of gravity of the top and bottom members was 12 ft. 9 in. The sides of the girders between the bearings were divided into fourteen equal parts by a pair of vertical bars, connected to the top and bottom by pins of puddled steel, 7 in. diameter at the ends of the girder, decreasing to 5 in. diameter at the centre; and each division contained a double set of two diagonals crossing each other. The top and the bottom of these girders were of boiler-plate, and consisted of horizontal tables 4 ft. and 3 ft. wide respectively, and of four vertical ribs, the two outer rows being 24 in. deep, and the two inner rows 21 in. deep. The aggregate thickness of the plates in the horizontal table of the top in the centre of the girder was 3⅛ in., and in the bottom 3 13-16 in., without the angle irons, and of 4⅛ in. and 4 13-16 in. respectively with the angle irons, but exclusively of the angle iron covers. It was arranged that, with the greatest load, the maximum strains should not exceed 4 tons per square inch in compression, and 5 tons per square inch in extension. All the rivet holes were drilled by machines capable of drilling several holes at one time. This plan was, under the circumstances, less costly than punching, besides which a great saving was effected in putting the work together. The diagonals acting as ties were of Howard's rolled suspension links, each separate tie being composed of two or three links, as required, riveted together. The diagonals acting as struts were each in one solid forging, and were united together in pairs by zig-zag bracing of wrought iron. In the centre of the girders, where the diagonals acted as both struts and ties, the pairs were united together in the two central spaces by the zig-zag work. The dimensions of the struts varied from 12 in. by 3 in. at the ends to 6 in. by 2½ in. in the middle, and of the ties from 12 in. by 2⅛ in. at the ends to 6 in. by 2 in. in the middle. The ends of the girders over the piers were boxed in, with plates ⅜ in. thick, stiffened by angle and T irons. Over the cylinders the girders rested on sheet lead, laid upon the granite blocks. On the brick piers and the Surrey abutment, they rested upon roller bed-plates. The girders were put together in place on a staging, the upper and lower platforms of which were accurately adjusted to the proper camber. The whole of the plates were drilled, and the struts and ties were completed, before being sent to the works. The weight of each main girder was 190 tons. One of the main girders was tested when in its place with a distributed load of 400 tons, when the greatest deflection observed was 1 5-16 in., and the permanent deflection after the load was removed was ½ in.

The cross-girders of the 154 ft. openings were of wrought iron, and were generally similar in character to the main girders, from which they were suspended, at intervals of 11 ft. apart, from centre to centre. They were 4 ft. deep in the middle, and 2 ft. 1⅛ in. deep where the cantilevers were united to them outside the main girders. The top and bottom consisted of two plates, 18 in. wide by ⅝ in. thick, the sides being of lattice bars united to the top and bottom by angle irons. The cantilevers decreased from 2 ft. 1⅛ in. deep at their junction with the cross-girders to 1 ft. 2 in. deep at their extremities. Each cross girder, including the two cantilevers, weighed 9 tons. When two of these cross girders, without the cantilevers, were tested with a load of 140 tons, equivalent to 70 tons on each girder, the maximum deflection in the centre was 1 in., and the permanent deflection when the load was removed was ¼ in.

The superstructure of the three 100 ft. openings of the fan end was supported by the brick pier and abutment on the Middlesex side of the suspension bridge, and intermediate to these by two rows of seven and of nine cast-iron cylinders, respectively. These cylinders were 10 ft. diameter below the ground level—the outer ones being 8 ft. diameter, and the inner ones 6 ft. diameter above that level. They were sunk to depths averaging 40 ft. below Trinity high-water mark, and were filled with Portland cement concrete to about 5 ft. above that level; but it was not considered necessary to fill in the remaining portion of these cylinders. On account of the great width of the fan end, which increased from 49 ft. 4 in. at the brick pier to 168 ft. at the abutment, the plan of supporting the roadway on cross-girders, suspended from outside main girders, was inadmissible; and as it was not desirable to introduce intermediate main girders, projecting above the line of rails, the roadway was carried by interior plate girders, laid at right-angles to the piers and abutment, and by the outside main girders, which were laid at the angle of inclination of the fan. The outside main girders were of the same depth, and were generally of the same character, although lighter in all the parts, and were fixed at the same level, as the girders of the 154 ft. openings. The interior plate girders were of the ordinary construction, 5 ft. deep, or 1-20th of the span, and weighed 26 tons each. The triangular spaces between the outside main girders and the outer interior plate girders were filled in with cross girders, terminated by cantilevers, projecting beyond the face girders, and similar to those outside the main girders of the 154 ft. openings.

The roadway platform over the 154 ft. openings consisted of planking 4 in. thick, spiked to longitudinal timbers, 15 in. by 15 in., placed underneath the rails, and bolted to the cross girders. Over the fan end, the platform consisted of planking 6 in. thick, secured to the girders. The footpath platforms were of planking 6 in. thick.

The first cylinder of the Charing-cross Bridge was pitched on the 6th of June, 1860, and as the bridge was now on the eve of completion, its construction would thus extend over a period of about three years. The weight of wrought iron in the bridge, including the steel pins, was 4,950 tons, and of cast iron 1,950 tons. The total cost, including the abutments, would be £180,000, or £1 15s. per square foot, and £131 per lineal foot. The cylinders of the 154 ft. openings cost complete £20 per lineal foot; the outer cylinders of the fan end cost about £12, and the inner ones about £10 per lineal foot. The bridge was designed by Mr. Hawkshaw (President Inst.C.E.), the Engineer to the Charing-cross Railway Company, and was carried out under his immediate supervision, Mr. John H. Stanton (M. Inst. C.E.) being the resident engineer. Mr. George Wythes was the contractor for the construction of the railway, but this bridge was sublet to Messrs. Cochrane and Co., whose representative on the works was Mr. Joseph Phillips (Assoc. Inst. C.E.)

ATMOSPHERIC TRIP HAMMERS.

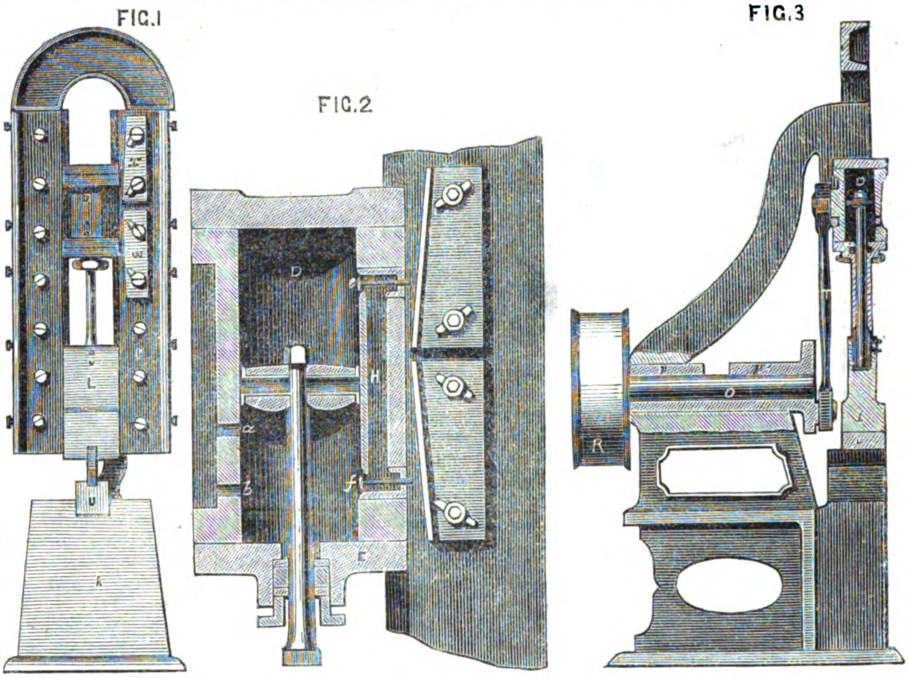
Mr. B. Hotchkiss, of New Haven, U.S.A., has recently patented an improvement in atmospheric trip hammers.

The frame consists of two parts, whereof the lower forms a bed to which the upper is bolted, an elastic substance being inserted under the washers of the nuts in order to lessen the effect produced by the blow of the hammer. The hammer is worked by means of an air cylinder, to which is imparted a vertical reciprocating motion. Within this cylinder is fitted a piston, to the rod of which the hammer is connected, the rod being enlarged at the part where the connection is formed in order to prevent the liability of its being broken. The atmospheric air is admitted into the cylinder through apertures so placed as to allow the air to pass thereinto at such periods as to cause it, by compression, to act as a spring between the piston and the lower end of the cylinder on the upward motion of the latter, and to impart an impelling force to the piston in a downward direction on the downward motion of the cylinder; or, instead of such apertures, two valves are fitted—one at the upper part of the cylinder, and the other at the lower part—with an air passage communicating between them, the rods of such valves being acted upon by coming in contract with adjustable inclined planes fixed on the side frame of the apparatus. The object of both these arrangements for admitting the atmospheric air to the cylinder is to regulate the force of the striking power imparted to the hammer without altering the speed of the driving shaft.

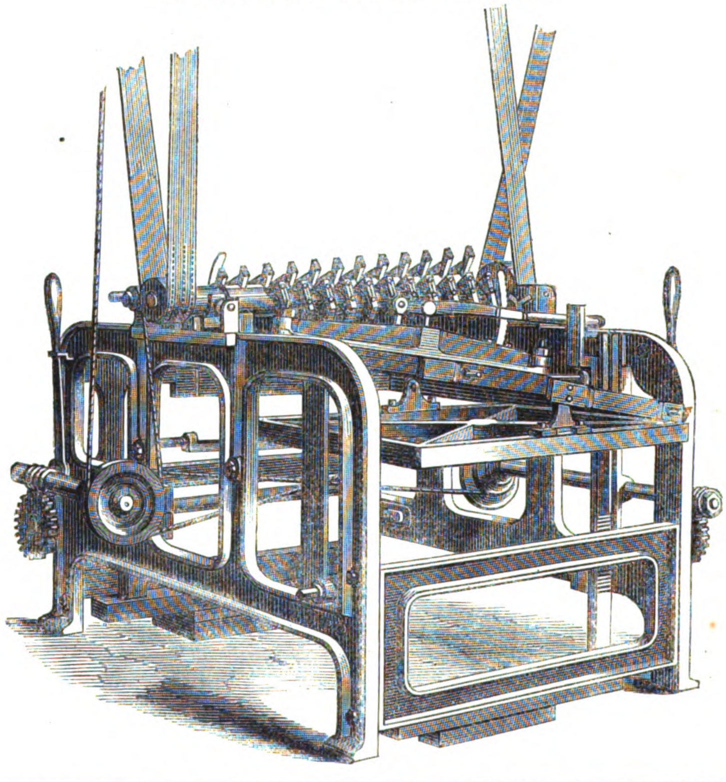
A is the lower frame, upon which the upper parts are supported. The upper frame B is so constructed as to form guides to receive and guide the air spring cylinder D; air passages *a*, *b*, are formed in the side of the cylinder, which passages are open to the external air. Instead, however, of these open passages, two valves *e*, *f*, may be inserted in the side of the cylinder or valve chest attached thereto, operated by adjustable mechanism. These valves should be placed near the ends of the cylinder to allow the stroke to be varied to a considerable extent, though not so far as, in any case, to prevent the blow from being cushioned so as to prevent damage to the to the parts. H is an air passage which connects the openings which contain the valves *e*, *f*, and is intended to allow the air which may be forced out of the cylinder at one end to pass into the other end of the cylinder, so that no loss may be occasioned, and no outside communication is in this case necessary. The piston is arranged within the cylinder, and has its rod extending through the lower head of the cylinder, and attached to the hammer L. O is the driving shafts which has its journals supported in boxes P, P. A pulley R is attached to this driving shaft, and at the opposite end of the shaft a crank wheel is fixed, in which a pin is inserted, and extends through the connecting rod T, the upper end of which is by a similar pin connected to the cylinder D. By applying power to the pulley R, motion will be imparted to the shaft O, and thence, through the connecting rod T, reciprocating vertical motion will be given to the pneumatic or air spring cylinder D, and in consequence thereof the hammer will be lifted and forced downwards towards the anvil U, or any article placed thereon. During each elevation or depression of the cylinder the piston will pass by the air passages *a* and *b*, and compress all the air that may be in the cylinder between the piston and the cylinder head. This compression of the air while the cylinder is descending will act as a spring to overcome gradually the inertia of the hammer, and prevent the piston from coming in contact with the lower head of the cylinder; so during the descent of the cylinder the air will be similarly compressed in its upper part, and will in like manner relieve the cylinder head above from the shock of the blow. The quantity of air compressed in the cylinder materially affects and controls the stroke of the hammer, and it will be obvious that by closing the lower hole or passage *b*, and opening the upper, a quantity of air to compress below the piston will be equal to the contents of the cylinder below the upper opening *a*; but by leaving the opening *b* open, the stroke is thereby reduced, as a less compression of air takes place, as it is obvious that the hammer will not be raised until the piston is met by the air below it in the cylinder, and that the cylinder produces no material effect upon the hammer between the points at which the air is left free to escape. This change, by means of a series of openings in any ordinary work not largely variable, may be sufficient for the purpose desired, but where a still greater range of variation in the stroke of the hammer is necessary, the valves *e*, *f*, may be employed. These valves open inward, and the operation of opening them is performed by the stems striking against the adjustable inclined planes W, X, which are fixed upon the frame for that purpose. These valves may be usually kept closed by spiral springs, or otherwise, as may be desirable.

A steam digging machine, invented by a French firm, has been successfully tried on the Emperor's model farm at Vincennes.

HOTCHKISS'S ATMOSPHERIC TRIP HAMMERS.



BURLEY'S DOVETAILING MACHINE.

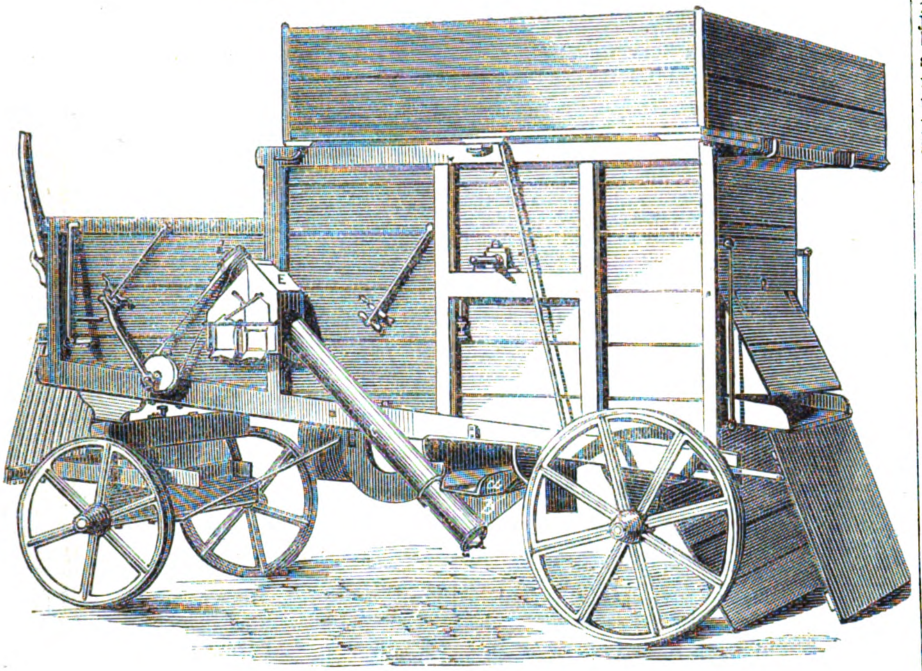


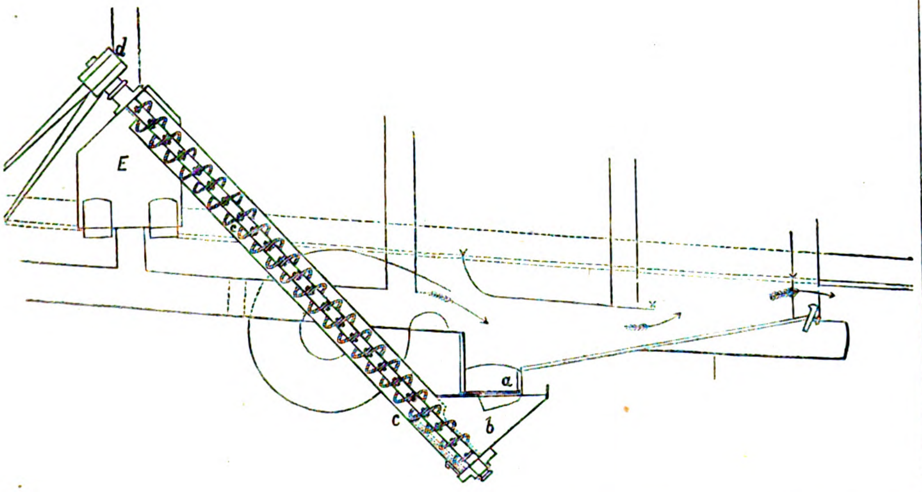
THE BURLEY PATENT DOVETAILING MACHINE.

This machine may be seen working at Messrs. E. Spencer and Co.'s Packing Case Factory, Billiter-steet, E.C. It is the invention of Mr. Thomas H. Burley, of New York, and consists of two rapidly revolving shafts, furnished by means of arms with cutters disposed at equal distances. On one shaft these cutters are disposed in the form of a cone, and on the other shaft at equal distances from its centre. The wood to be operated upon is placed on a rising and falling table, with the end to be dovetailed parallel to the edge of the conically disposed cutters, and is held in that position by a lever and clamp. Motion is given to the table by the side handle, and it rises until it reaches the centre of the cutter shaft, when it trips itself and falls; the wood is then turned over, and on the same operation being repeated, the mortises are completed ready for use.

The "pins" are made by the plain cutters, but in order to make a bevel corresponding to the mortises, the table on which the wood is placed is made to tilt both ways, and rises against the cutters, first on one angle and then on the other, and by these means completing the pins. The depth of mortises and length of pins is regulated by set screws, which admit of easy adjustment.

WATTS' COMBINED THRASHING MACHINE.





ADAMS' IMPROVED SLIDE VALVES.

FIG. 1

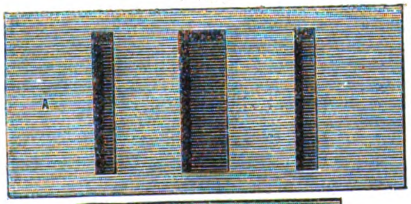


FIG. 5

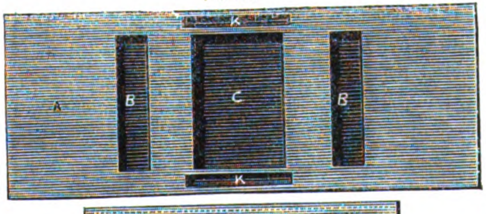


FIG. 2

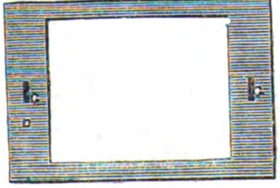


FIG. 4

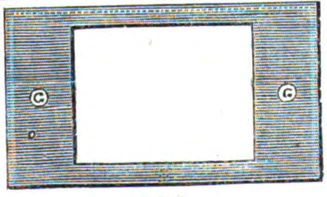


FIG. 3

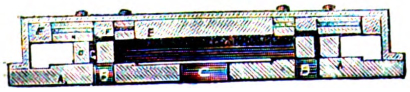
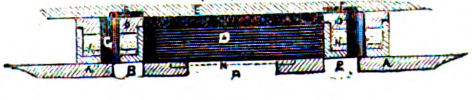


FIG. 6



WATTS' COMBINED THRASHING MACHINE.

MR. T. WATTS, of Carisbrooke, Isle of Wight, has just obtained a patent for "improvements in combined thrashing machines," The invention consists of forming a screw, the thread of which is made of thin iron plate. This screw revolves in the inside of a sheet-iron cylinder, and is for the purpose of elevating and dressing corn and other grain.

The annexed engravings shew a view of the machine with elevator and appendages attached, and a detached view of the elevator in section. *a* is the shute which conducts the corn to the lower hopper, which is fitted with a perforated bottom, thereby forming an extra riddle to carry the short straws or ears over the hopper and drop them on the outside; *b* is the lower hopper, which is fitted with a slide and opening in order to let all grain out of the cylinder when finishing; *c*, the cylinder through which the grain is elevated and dressed; *d*, the pulley on screw spindle which gives motion to screw inside of cylinder, receiving its motion by means of a rectangular band or strap; E, the delivery box, to which bags or sacks are hooked to receive the corn or other grain.

ADAMS' IMPROVED SLIDE VALVES.

THE improved slide valve illustrated in the above engravings has been recently patented by Mr. T. Adams, of Deptford. The object of the invention is the production of an equilibrium of the steam, fluid, or gaseous pressure on the valve by causing the steam, fluid, or gas to act with equal pressure on opposite sides of the valve at the same time, thereby obviating the loss of power caused by the unbalanced pressure on the valves as they are ordinarily constructed and arranged. For this purpose recesses are formed in the door or front of the slide valve box, or in the valve, in such situations as to admit of the steam, fluid, or gas passing at the same time to opposite sides of the valve. There are also passages through the valve so as to form communications between the ordinary ports leading into the cylinder, and the recesses or false ports. By this arrangement the pressure on the valve of the steam, fluid, or gas, as it enters or escapes from the cylinder through the ordinary ports, is balanced by the pressure of the same on the opposite part of the valve, thereby effecting a constant equilibrium of pressures on the valve.

Fig. 1 is a plan of the cylinder face, and fig. 3 is a section through the valve, valve box, and cylinder face. A is the cylinder face; B, B, are the ports communicating with the cylinder; C, is the exhaust port; and D, is the slide valve, which is cut out in the central part, as shown, leaving only a frame of metal. It will also be seen on reference to fig. 3, that the valve fits the space between the door E of the valve box and the cylinder face, so as not to admit of steam pressing the valve on to the cylinder face, except in the false ports F, F, oppposite to the ports B, B, where the pressure is balanced by that in the latter ports. G, G, are the communications between the ordinary ports B, B, and the false ports F, F, through the valve. H, H, are plates between which suitable packing is placed, in order to give elasticity to the plates against which the valve works. The steam from the boiler is caused to press on the opposite ends of the valve at the same time, thereby producing an equilibrium of pressures on the valve in the horizontal direction, also that the pressure of the steam in the ports B, B, will be balanced by that in the false ports F, F, the steam being free to pass from the former to the latter, and causing an equilibrium of pressures on the valve in the vertical direction. The exhaust also acts equally on the inner sides of the valve.

In figs. 4, 5, and 6, the same principle of constructing slide valves, so as to effect an equilibrium of pressure thereon, in working is shown; but in this case the valve is divided into two parts (which may be termed the male and female portions of the valve) with packing inserted between them. The only difference between this construction of valve and that above described is that, whereas in the former instance the valve was in one piece, with the packing inserted in the door of the valve-box, in the present instance the valve is divided into two parts D D, with the packing inserted between them. Owing to this mode of constructing the valve, there will be a space all round it, in which there will be a pressure of steam having a tendency to force the upper portion against the door E, and the lower portion against the cylinder face A. In order to balance this pressure it is necessary to form recesses K, K, both in the door E and the cylinder face A of an area equal to that of the space round the valve. There is a passage for steam into the recesses formed either in the valve, or the cylinder face, or the door. Should it be required to apply pressure on the valve for the purpose of keeping it on its face, any required amount of pressure may be applied thereto by making the recesses less in area than the space round the valve.

THE LATE MR. JAMES FENTON, C.E.

ANOTHER old name in the engineering world has departed. Mr. Fenton, of Low Moor, after a very protracted illness, died at Leamington, on the 22nd ult., at the early age of 47. We said an old name; for though a young man, Mr. Fenton very early secured a first-class position in the railway world, which he retained till his death. After leaving the Glasgow University, Mr. Fenton was for some time employed, under Brunel, on the Great Western Railway, which was then being constructed. We next find him on the Leeds and Thirsk line; after which he became the Locomotive Superintendent of the Lancashire and Yorkshire Railway. Some 17 years ago he left the service of that company to undertake the management of the Railway Foundry, Leeds; among the various works he executed while in that position may be mentioned the Jenny Lind class of engine—a class possessing great simplicity, and combining steadiness with speed; so highly were these engines thought of on some lines, that they became adopted as the type for all their passenger engines. On one line, the Midland, nearly the whole of their passenger engines were, until they were compelled a few years ago to make a heavier engine, of the Jenny Lind class. Mr. Fenton, also when at the Railway Foundry, constructed and launched one of the largest landing-stages in the kingdom, that at New Holland, where the passengers by the Manchester and Sheffield Railway cross to Hull. Some ten years ago Mr. Fenton became consulting engineer to the Low Moor Company, a position of the highest standing, which he retained to his death; and here he had ample opportunity of meeting all engineers of high reputation, and this soon brought him a very large practice. As a witness he had great powers of explaining mechanical details in a popular style; his last professional engagement was from the War Office. He was appointed by the Government to settle the question of compensation to the Elswick Company. During the attendance on this business in London he caught a severe cold, which hastened his end. Mr. Fenton was a well-known and valued member of the Institution of Civil Engineers, and for many years had been one of the vice-presidents of the Institution of Mechanical Engineers, in the management of which he took an active part. Mr. Fenton's loss will be much felt by many of our young engineers. He was always ready with his advice and assistance; and it may be truly said that he left no enemies behind him. Mr. Fenton was buried at Low Moor on Monday last, and was followed to the grave by Messrs. Wickham and Hardy, the managing partners of the Low Moor Iron Company, Joseph Freeman, and many of his old friends—Messrs. Wilson, of the West Midland; Kirtley, Fernie, Pettifer, and Alton, of the Midland; Johnson, of the Manchester, Sheffield, and Lincolnshire; Brown, of the Edinburgh and Glasgow. Mr. Fenton leaves a widow, two sons, and three daughters to lament his loss.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

APRIL 23rd, 1863.—Francis Campin, President, in the chair.

"ON MARINE SURVEYING."

By Frederic E. Cooper and G. J. Crosbie Dawson.

AFTER a suitable preface, Mr. Dawson, who read the Paper, went on to say:—As necessarily the greater part of these operations would be carried on in the water, it will be obvious that a safe and manageable means of transit will be of importance, varying of course with the requirements of the place. When there is but a little current or tide, a two-oared boat will generally be found sufficient; but when the tide runs strong or there is a heavy current, the number of oars must be increased, for facility of motion is greatly required. Very often when surveys are made in the open sea, a steamboat is advantageously made use of.

The instruments that will be necessary are a box-sextant and a sounding line. It will be unnecessary here to give a description of the box-sextant, most being conversant with its construction and uses. The sounding line should be of stout cord, and should be marked while wet in fathoms, by means of strips of leather, according to the number of fathoms. The lead should be about 9 lb. weight, somewhere about 1 ft. long, about 2 in. in diameter at the lower end, and 1 in. at the top.

In sea sounding and where it is desirable to ascertain the nature of the bed, the common practice is to have what is termed the dead-eye in the lead, which is a small cavity in the bottom, 2 in. deep, filled with tallow, to which the substance forming the bed adheres.

Where the depth does not exceed 12 ft., a sounding pole is useful, and will be found more manageable than the lead. This is a rod of light wood about 1¼ in. in diameter, marked in feet and inches, with a flat piece of wood at the bottom to prevent its weight forcing it into the mud, and thus giving a false sounding.

In tidal waters the tide gauge is of great importance. It is a board marked plainly in feet and half feet, of a sufficient length to take in the rise of the tide. This should be fixed at some convenient spot not too exposed, yet capable of marking the rise of the tide accurately; its zero should be fixed to some convenient datum, such as low water spring tides—and during the time that soundings are going on, this gauge should be watched by an attendant, and the successive rise of the tide noted with the exact time, usually at intervals of ten minutes.

In surveying rivers and foreshores, the most usual method of obtaining a correct idea of the course of the bed is by sounding lines at right angles to the course of the river or shore, sufficiently near to each other to ensure correctness in result. To do this, we first mark out on each bank or on the shore the lines intended to be taken by means of flags, ascertaining their position by measurement from objects before obtained; then fix upon one or two known points, or if there are none suitable plant a flag at a distance about equal to half the length of the line to be sounded on either side of it, for the purpose of intersection—a church tower, prominent house, or windmill, &c., will answer the purpose very well.

If circumstances suit, we now proceed to sound. The best time for doing so is usually at low water, or a little before or after. The boat should contain the necessary number of oarsmen, and a steersman who might also "keep the book," for the principal will have to take the angles, which he will find quite enough to do; and as everything depends upon the position of the sounding, great accuracy here is of importance; there must also be a reliable person to take the soundings, one not apt to make a mistake of a fathom, as nothing is easier to do, and such a thing, of course, renders the work of very little use, for it ought with due care to be correct to 6 in. In sounding with the lead, the depths will frequently be between two of the fathom marks, therefore when a sounding is taken, the line should be grasped by the forefinger and thumb at the water mark, while the other hand holds the nearest fathom mark to the sounding rod, by which means the correct reading can easily be seen.

Now, having started our boat, we get into the line to be sounded by careful rowing and steering, a result which is known to be arrived at when the two flags on both sides are in line, or as it is termed "on." The word is now given to proceed: the boat is rowed slowly and steadily in the line to be sounded; the sounder commences his work, throwing in the line as fast as possible, and calling out each successive depth distinctly, which is immediately booked. The person who takes the angles does so as fast as he possibly can, taking them, of course, between the line sounding and the object, or flag put in, for the purpose of intersection; he calls them out as soon as taken, and they are booked, as well also as the time, and the depth of the soundings taken at that time. The book should be divided into five columns, viz., 1st, the angle; 2nd, the time; 3rd, the sounding; 4th, the tide gauge; and 5th, the reduced depths for plotting, and should read thus, say, 22° 30′; 12.25; 15 ft.; 4 ft. 6 in.; 10 ft. 6 in. The figures for the tide gauge are obtained afterwards, and put down in the book to the proper time; the depth on the tide gauge being subtracted from the sounding, gives the reduced result above the datum. Thus the work proceeds until the river is crossed, or until a sufficient distance has been sounded.

In order to check the work as it proceeds, it is usual occasionally to take an angle on each side of the line, and then if the three lines meet in one point on the plot, there is no doubt as to the accuracy of the work. The distance between each angle taken should vary with the bed of the river; sufficient should be taken so as to be able to delineate it accurately; the deepest and shallowest sounding should, in all cases, be fixed by an angle, and the soundings should be taken continuously to guard against shoals and holes being overlooked.

When a marine survey is being made of a considerable extent, such as of a bay, frith, or channel, &c., we require a little more diversity in the lines sounded; great help will be afforded if there are buoys or definite points where the survey is to be made. These should be accurately laid down on the plan, by intersecting them from two or more known points on shore, by means of a theodolite. If there are no definite points, it is sometimes advisable to improvise something of the sort, by mooring casks, &c., where required. Buoys and floating points should be intersected at high or low water, as the water then is nearly still, for as their moorings are necessarily long, there is a considerable difference in their positions at various states of the tide. It is best to intersect at high water, for the mooring then is nearly vertical. Having fixed the points, we should take soundings between them; in the case of buoys marking the deep water channel, it is absolutely necessary to sound in their direction.

In making a marine survey of a coast, where there are no particularly defined points from which to measure, in order to set out our lines to be sounded, a very convenient method is to measure a base along the shore, driving stakes at distances which the lines to be taken are desired to be from each other, usually about 100 ft.; at each of these points we can set out by means of a theodolite and flags the lines themselves.

Hitherto we have only considered marine surveying with regard to water; that is, sounding. We shall now proceed to mention a few methods by which, what we may term periodically dry land, such as shoals which are alternately covered by water and laid bare, are surveyed. Those parts which are dry at low water and are of sufficient consistency to bear walking on, are best surveyed by landing on them at dead low water, fixing points on them by means of angles to the shore, and rapidly surveying them in the usual manner, by running lines round with the chain, judging and sketching-in the offsets.

When the nature of the soil is so soft as to preclude walking on, you must run your boat as near as possible, and fix the main points by means of angles, and then sketch in the form of the shoal between. Here great expedition is required; and great care should be taken with the time and tide-gauge, for the tide rises very fast usually, and the shape of a shoal alters materially with the least possible rise.

Mr. Dawson then, by the aid of diagrams, explained one or two methods for fixing points at sea, where soundings have been taken.

He then affirmed that—Another important object in marine surveying is to ascertain the direction and rate of the currents in which the tide flows' These results are usually obtained in the following manner:—At low water we proceed to the farthest point, in a boat, having provided a number of floats, made by cutting pieces of plank about 6 in. by 12 in. half through in the middle, and putting two together, so as to form a cross. We drop one or two of these in places where the current appears to run the strongest, following in our boat that which takes the lead, marking its position at intervals by fixed points, noting the time as well; thus having obtained these points, it is easy to determine the rate at which the tide runs, and in what directions. If any of the floats are stopped, or get into eddies, or if anything occurs to prevent the obtaining of a true result, we drop others; and by repeating these operations an accurate result is usually obtainable. The rate of tide current is from 1 to 5¼ miles an hour, varying very much, and is usually strongest at about half-flood and ebb.—Mr. Dawson then referred to deep sea soundings, and gave, in a condensed form, what Lieut. Maury, of the U.S. Navy, states upon the subject. He afterwards mentioned Mr. Brooks's, of the U.S. Navy, apparatus for deep sea sounding, as being the best yet invented. The working of this was clearly shown by a diagram. The authors concluded their Paper by hoping that it had been of some interest, inasmuch as there are so very few, if any, works published on the subject.

ROYAL SCOTTISH SOCIETY OF ARTS.

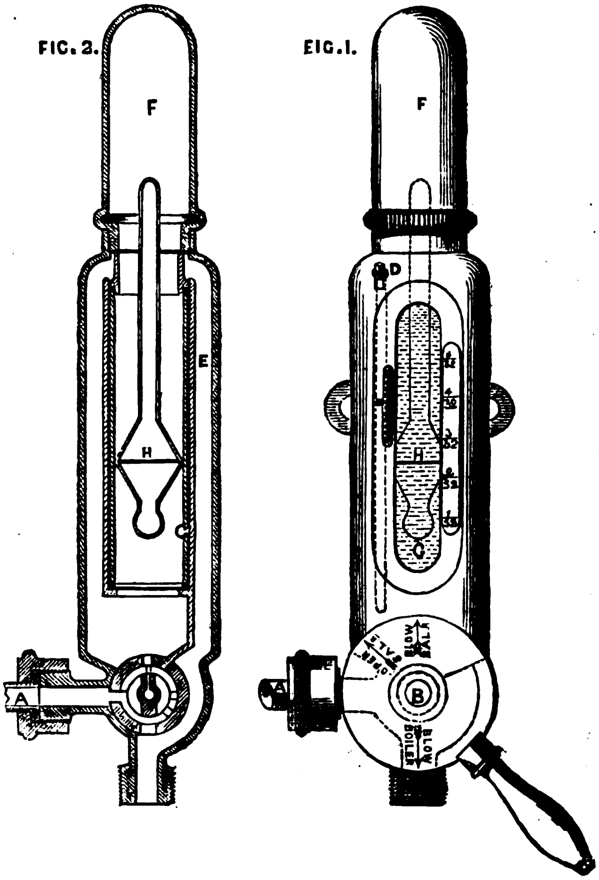
On Monday night, a meeting of this society was held in their hall, 117, George-street, Edinburgh, Dr. Stevenson Macadam, president of the society, in the chair. Mr. Edward Sang read a communication "On the Nature and Management of the Sefinet Equation for determining the Form of a Ship's Hull," which was illustrated by a model and a series of diagrams. The Paper was remitted to a committee. There was also remitted to a committee a Paper by the Rev. James Newlands Miller, "On the Effective Power transmitted from the Piston-rod to the Crank of the Steam-engine; the Work effected by the Crank; and the Lateral Strain on the Piston-rod at its Junction with the Connecting-rod." The last communication was one by Mr. Gray, engineer, Gas Works Dunfermline, giving a "Description of an Apparatus for Impregnating Gases with a Vapour of Volatile Hydrocarbon Fluids, and suitable for the purposes of Illumination." The Paper was illustrated by a model and drawings. It was remitted to a committee. Reports were read from committees on Mr. Alexander Cunningham's Paper, "On Fogs at Sea and Fog Signals on Shore," and on Mr. Heriot Currie's proposed improvement in the mode of taking in the injection water to supply marine condensing engines. The report on Mr. Currie's Paper was to the effect that the committee could not recommend the proposed improvement to the favourable consideration of the society. The report on Mr. Cunningham's Paper recommended that it should be handed for consideration to the Society's Printing Committee, as likely, if published, to prove a useful means of calling attention to an unsolved problem.

TRIAL TRIP OF AN ITALIAN ROYAL MAIL STEAMSHIP.

On Thursday last week, the "Marco Polo," a fine paddle steamer of 750 tons B.M., built by Messrs. Wm. Simons and Co., at the London Works, Renfrew, sailed down the river on her trial trip, and gave entire satisfaction to her owners, who were on board. This vessel, launched recently with all her machinery on board, is a beautiful specimen of marine architecture. She is 220 feet in length, 26 in breadth, 14 feet deep, is, as already stated, 750 tons burden, and will be propelled by a pair of oscillating vertical engines of 250-horse power, supplied with steam by four tubular boilers, fired from 12 furnaces. She is fitted with feathering float paddles, and all other improvements to secure speed, and economy of fuel in working. The arrangements for the comfort, nay luxurious ease, of passengers, are quite complete; and ample accommodation has been made for the officers and crew of the ship. The saloon, which is on deck, forming a full poop, is 50 feet long by 20 feet in breadth, with a height of 7 feet 9 inches. This apartment is decorated with all the taste and refinement and in the style of a first-class drawing-room. What may be called the walls are adorned with beautiful paintings, representing Italian places of interest, such as Sorrento, the Tiber, Pomaret, Fort-Beil-Gorod, the Sido port of Venice, the town and harbour of Bona, the Bay of Naples, Mount Etna, Bona, and Palermo, between which, in the centre of bird-eye maple panels, are emblazoned coats of arms of such towns as Siragusa, Livorno, Torino, Lucca, Messina, Catania, Ravenna, Cagliari, Milano, Genova. There is a large amount of gilding throughout the saloon, and with a judicious introduction of stained glass, mirrors, crimson velvet cushions, and lounges, a splendid rosewood piano-forte, and beautiful candelabra, the saloon presents an appearance of splendour and comfort of which few vessels can boast. Adjoining the saloon is a handsomely fitted up ambassador's room; and below the saloon is a double range of sleeping cabins, with two ladies' state rooms, all of which are well lighted and ventilated. The accommodation for second-class passengers is also excellent, there being three rooms set apart for them—in the one are sixteen berths, and in the others nine and seven respectively.

GAMBLE'S PATENT SALINOMETER.

GAMBLE'S SALINOMETER.



Of the advantages which result from the use of salinometers for ascertaining the density of the water in marine boilers, it would doubtless seem somewhat late in the day now to speak—inasmuch as they are universally recognized and admitted to be beyond dispute—salinometers in some form or other being employed in every sea-going steamer with a resulting economy in fuel and the prevention of injury to the boiler. However, amongst the different varieties of the salinometer introduced, many are open to objection—some from their complexity and liability to derangement, and others in consequence of the aim at extreme simplicity having caused them to be deficient in contrivances for protecting the engineer from injury by scalding, and the hydrometer and thermometer from breakage. From this oversight many patented contrivances possessing a certain degree of merit have entirely ceased to be used, or are only used with precautionary modifications suggested by the ingenuity of the engineer in charge. That some improvements are required by which a salinometer could be made which should be free from any of the above objections, has long been felt, and more especially has this been the case with those into whose charge such instruments are committed for use. The salinometer which we illustrate above is the invention of Mr. W. S. Gamble, for whom Mr. M. A. Soul, of Leadenhall-street, is the sole agent. A is the inlet communicating with a three-wayed cock, by which the operation of blowing out the supply-pipe and salinometer can be performed in a few seconds. B is a conical pointed screw fitted in the head of the cock plug, by which the supply of water can be regulated for keeping up the required temperature in the salinometer. C is a glass tube through which the hydrometer is seen; the density of water is here read, from a coloured glass ring around the circumference of the bulb—the scale is affixed to the outer casing of the salinometer. D is a hole for inserting the thermometer, into which a screw is fitted afterwards. E is a communication passing up between the outer and inner cylinders to the top of the instrument, by which the surplus water is carried off. F is a cover screwing on to the case, inside which the stem of the hydrometer rises; this cover entirely prevents ebullition, and forms the whole into one complete instrument, which can be attached to the boiler front if required, without any possibility of scalding persons engaged beneath.

The Prussian Minister of Commerce has authorized the construction of a railway from Dantzic to the frontier of the kingdom of Poland.

Meetings for the Week.

Mon.—*British Architects.*—Annual Meeting of Members, at 8 p.m.

Medical.—Council Meeting, at 8 p.m.

United Service Inst.—At 8.30 p.m.

Geologists' Association.—"On some Recent Shells found in Lancashire," by J. Rofe, F.G.S. "Geological Ramble on the Banks of the Medway," by Prof. Tennant, at 7 p.m.

Tues.—*Inst. Civil Engineers.*—"American Iron Bridges," by Zerah Colburn, Esq., at 8 p.m.

Wed.—*Soc. of Arts.*—"On Bread-making, with Reference to the Condition of those employed in its Manufacture," by Dr. Andrew Wynter, at 8 p.m.

Geological.—I. "On the Brick-pit at Lexden," by Rev. O. Fisher, M.A.; with a note on the *Coleoptera*, by T. V. Wollaston, Esq., F.R.S. II. "On the Original Nature of Mica-schist," by H. C. Sorby, Esq. III. "On the Fossil Corals of the West Indies. Part I.," by P. M. Duncan, M.D., at 8.30 p.m.

Thurs.—*Antiquaries.*—At 8.30 p.m.

Linnæan.—At 8 p.m.

Royal Soc.—At 8.30 p.m.

Chemical.—At 8 p.m.

Fri. — *United Service Inst.*—"The Recent Campaigns in Virginia and Maryland," by Major F. S. Taylor, at 3 p.m.

London Inst.—"On Economic Botany," by R. Bentley, Esq., at 7 p.m.

Architectural Association.—Class of Design—Choir and Chancel Screen.

Horsham, Dorking, and Leatherhead Railway.—The ceremony of cutting the first sod of this new line of railway, was performed on Saturday last, at Horsham, by Mr. Seymour Fitzgerald, M.P. By this project, in addition to numerous local advantages, a new main line will be established between London and Brighton, passing by Shoreham, Horsham, Dorking, and Leatherhead, which will be entirely distinct from the existing main line, and only a few miles longer. On this line there will be only two short tunnels, between London and Brighton—one at Dorking, of a little over 300 yards, and the other at Mickleham, of about 500 yards, the passage through each of which will only occupy the fraction of a minute. The length of the line from Horsham to Dorking is 18¼ miles.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—J. Y.—M. A. S.—J. J. M.—Rev. T. O. M.—O. J. R.—R. P. (your suggestion is impracticable).—H. G.—R. M. L.—F. R.—Com. T. E. S.—Messrs. L. Bros.—R. T.—J. C.

J. Y.—Our meaning was that coal is only lately being introduced for locomotives after coke had been exclusively used for so many years. The "desiderata" are simply a perforated fire-door, a fire-brick arch, and a deflecting plate, applied to the locomotive fire-box. We then gave it as an instance illustrating the difficulty of arriving at once at a simple solution of a mechanical problem, and as an illustration of the fallacy of the opinion that such questions are solved by a process of "spontaneous generation."

I. D. (Hadham).—Your proposed arrangements are simply absurd. 1. How, in the name of common sense, can you expect to prevent steam boiler explosions due to overpressure by merely separating the steam from the water? 2. Your water-valve would not work in time; and, even if this were the case, it would be a danger of itself, and the remedy would be worse than the disease.

T. L.—You had best see the "London University Calendar" for complete particulars, but the full time required for the degree of Doctor of Science at the London University is four years from the matriculation examination. You must pass two examinations in mathematics, including arithmetic and algebra, geometry, plain trigonometry, mechanical and natural philosophy, chemistry, botany, and zoology, before you can obtain the degree of Bachelor. After that, you must wait two years before you can pass for Doctor of Science. For a German Ph.D. degree, a residence at the University of a fortnight to six weeks is required; but, besides this, a candidate must be prepared with good testimonials, a thesis of some sort or other, and about £50 in money.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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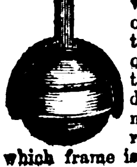
PANTAGRAPH SUPPORTING WHEELS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I forward for insertion in the Mechanics' Magazine the following simple plan of a substitute for the supporting wheel of a pantagraph, or for any similar purpose. I was led to its contrivance on account of the annoyance experienced from the jerk, which takes place with the ordinary wheel when quick turns are to be made by the pantagraph. The drawing (full size) represents a boy's marble inclosed between two curtain rings, which are soldered to a frame, which frame is an old stretcher of an umbrella. Your readers may, of course, employ more elaborate materials, but they will find the above rough and ready ones to answer.

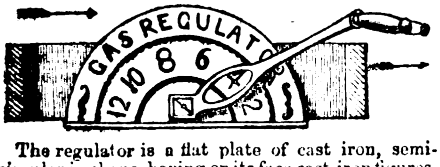


I am, Sir, yours respectfully,
N. S. Heineken.

Sidmouth, April 16, 1863.

GAS REGULATORS.

Sir,—With this I send you a sketch of a cheap gas regulator, by the use of which any person may regulate the supply of gas to the number of burners used. It consists of an ordinary 1¼ in. gas tap, the key of which has a perforation, through which the number of lights required can be seen on the regulating plate.



The regulator is a flat plate of cast iron, semicircular in shape, having on its face cast-iron figures, so arranged that when, for instance, the tap is at 6, only sufficient gas for 6 ordinary burners will be admitted into the pipes leading from the meter.

I am, Sir, yours truly,
Henry Baker.

Miscellanea.

We learn that Messrs. Gwynne and Co. have received orders from the Admiralty for the supply of the pumping engines for the new docks at Malta (their patent centrifugal pump is to be used), and of a capacity capable of discharging 25,000 tons of water in 4 hours. Messrs. Gwynne have also in hand a pair of engines with their centrifugal pumps, for the dry dock of Messrs. Palmer Bros., shipbuilders, Newcastle-on-Tyne, and to discharge 240,000 cubic feet of water in 3 hours, for the new floating dock for the Dutch Government being constructed in Holland.

The Steamer "Prince Consort."—We are gratified, says the *Aberdeen Journal*, to announce that the operations which have been for a short time carried on in connection with the wreck of this vessel at the entrance to the Harbour, were brought to a successful termination early yesterday norning, when the whole mass, engines, boilers, and hull, weighing about 600 tons, was floated from off the dangerous and rocky platform where it lay, and brought to the gridiron at Messrs Hall and Co.'s building-yard, where it now lies in perfect security. The apparatus adopted for effecting this is a patent invention of Captain Jonathan Russell, of Lloyd's, worked by the Pneumatic Ship-raising and Universal Salvage Company of London, and applied under the superintendence of Mr. Caulfield, one of their directors. The novelty of the system excited more than ordinary interest But the powerful appliances brought into use, with the active exertions of Mr. Caulfield, of Mr. Leckie, the manager for the owners, and of Captain Gauld, pilot-master, rendered this very difficult operation a complete success. The caissons used on the occasion were manufactured by C. Macintosh and Co., Cambridge-street, Manchester, and 3, Cannon-street West, London.

Iron-clads.—The presence before Charleston, says the *New York Times*, of three distinct types of iron-clads, represented by the "Monitors," the "Keokuk," and the "Ironsides," affords an interesting means of comparing the relative merits of the different models. The test is, however, hardly a fair one, as some of the vessels were much more exposed to fire than others. It would have been interesting, for example, to have seen how the "Ironsides" would have behaved under the amount of fire received by the "Keokuk," and under the same range at which she was placed. This would also have afforded the means of testing the relative strength of continuous and of laminated armour—the plating of the "Ironsides" being one single 4½ in. mass of wrought iron, and that of the "Monitors" in series of 1 in. plates. So far as we may be justified in drawing an induction from a limited range of facts, the advantage would seem to incline to the continuous thick plating. The exposed overhanging port-covers, employed both on the "Ironsides" and "Keokuk," and which in the case of both ships were in several instances shot away, appears to be an undeniable weakness. The riddling of the armour of the "Keokuk's" turrets, which consists of 5¾ in. of iron, presents a striking proof of the penetrating power of the improved modern projectiles; and the effect produced by the square-headed and steel-pointed shot would seem to justify all that has been anticipated of their power. The "Nahant" received several bad fractures of the deck and sides, below and above the water line. The most fatal blow, however, was given by a heavy rifled shot, which struck the pilot-house, and dislodged several of the bolts, one of which, driven violently inwards, wounded all of the three inmates of the pilot-house. The most extraordinary shot the "Passaic" received was from a large 10-in. rifled projectile, which struck the top of the turret, scooping out a huge portion of the iron, breaking all of the eleven plates of an inch thickness each, and spending its force on the pilot-house (which is placed on the top of the turret), in which it made a crater 3 in. deep, and producing such a shock on the pilot-house as to start its top and raise it up three inches! Had not the force of the impact been broken on the turret, there can be little doubt that this shot would have gone clean through the pilot-house. Another shot hit the turret, forcing the place struck inwards, and producing a big swell on the interior. The same shock disabled the carriage of the 11-in. gun, while portions of the interior iron casing fell down, and, lodging in the groove of the turret, stopped its revolution. The "Nantucket," besides receiving a number of wounds, had her turret so jarred that the cover of the port could not be opened, and, consequently, the 15-in. gun could not be used. These three, the "Passaic," "Nahant," and "Nantucket," are all of the "Monitor" type.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2739.
Boilers and Furnaces, 2713.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2683, 2702, 2704, 2737.
Ships and Boats, including their fittings, 2693, 2714, 2719, 2722, 2727, 2735, 2740.
Cultivation of the Soil, including agricultural implements and machines, 2699, 2712.
Food and Beverages, including apparatus for preparing food for men and animals, 2686, 2701, 2706.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2680, 2681, 2691, 2694, 2715, 2717, 2724, 2728.
Buildings and Building Materials, 2695, 2696, 2725, 2738.
Lighting, Heating, and Ventilating, 2684, 2688, 2690, 2711, 2741.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2685, 2689, 2697, 2705, 2709, 2716, 2721, 2731.
Metals, including apparatus for their manufacture, 2708, 2730.
Chemistry and Photography, 2698, 2718, 2729.
Electrical Apparatus, 2734.
Warfare, 2710, 2723.
Letter-Press Printing, 2733, 2736.
Miscellaneous, 2682, 2687, 2692, 2700, 2703, 2707, 2720, 2726, 2732.

2680. A. Barclay. *Improvements in printing textile materials and fabrics, and in machinery therefor.* Dated October 4, 1862.

This invention comprises improvements more particularly designed for printing yarns or warps to be afterwards woven into piece goods, but also in part applicable for printing woven fabrics. In one modification of machinery or apparatus for carrying the invention into practical effect, the yarns or warps having been first beamed or wound in a regular way upon one or more beams or rollers, and such beam or beams having been placed in supports provided for them in the machine, are drawn thence and made to pass round more or less of the circumference of what may be termed the impression cylinder. In passing round such impression cylinder, the warps receive the desired impressions from one or more printing rollers, in one or more colours, the impressions being, by preference, produced by relief surfaces, and the printing rollers being disposed with their colour supplying details according to any suitable arrangement such as is at present in use for printing woven fabrics. The printing roller may be supplied with colour either by a sieve or small endless blanket passed round two rollers, the lower one dipping down into the colour trough; or it may be supplied by means of a series of two or more elastic surface rollers, the lowest revolving in the colour trough, and imparting its colour to the next in contact with it, and this one again either to a third, or directly to the printing roller. There is interposed between the warps and the surface of the impression cylinder an endless blanket of glazed or varnished cloth to form a suitable back surface behind the warps, and which receives the portions of colour which pass through or between the warps. This endless cloth or blanket is of sufficient length to be passed over guide rollers to a little distance from the impression cylinder, and it is made to pass through washing apparatus, which may consist of a trough of water with frictional appliances contrived to act on the cloth or blanket. From the washing apparatus the cloth or blanket passes between squeezing rollers to remove the moisture, and, if necessary, in contact with a rubbing surface when it is rendered fit to re-enter upon the impression drum without any possibility of spoiling the warps with which it comes in contact. The printed warps are made to leave the impression cylinder, by preference, in a horizontal direction, and are immediately subjected to the drying action of heat. *Patent completed.*

2681. W. E. Gedge. *Improved means or apparatus by the use of which pierced or perforated cocoons may be spun.* (A communication.) Dated October 4, 1862.

This invention is not described apart from the drawings. *Patent comptcled.*

2682. S. Amphlet. *An improvement or improvements in ornamenting surfaces of wood.* Dated October 4, 1862.

This invention consists in ornamenting surfaces of wood by mounting directly thereon photographs of objects from which the background has been cut away, the surface of the wood on which the said photographs are mounted constituting the background to the said photographs. *Patent abandoned.*

2683. J. E. Billups. *Fixed points for railways.* Dated October 4, 1862.

This invention consists in dispensing with the moveable tongues and switches, and substituting in place thereof fixed points, so arranged that they will always keep the carriages, engine, or otherwise within a proper track. *Patent completed.*

2684. J. M. Cabirol. *A submarine lamp.* Dated October 4, 1862.

The main features of this invention consist in condensing or taking up the heat of the current of smoke and air issuing from the lamp, thus cooling it to such a degree that it cannot burn or injure the flexible tubing which is employed in this lamp. The patentee attains this object by causing the said current to pass down outside of the lamp into a coil, where it is cooled by contact. Another feature consists in drawing off the said current, through a pipe, terminating the said coil by means of an air-pump, thus creating a partial vacuum, which causes the external air to rush in through another pipe into a distributing passage provided for that purpose near the bottom of the lamp. This submarine lamp is made up, besides the piping mentioned, of two hollow spheres of crystal, the lower and larger one containing a Carcel moderator or other lamp, and the upper one, which communicates by the lamp funnel only with the lower sphere, receiving the products of combustion, which are drawn off into the refrigerating coil, as before described. *Patent abandoned.*

2685. F. PARKINSON. *Improvements in ladies' shawls and cloaks.* Dated October 4, 1862.

This invention consists in forming or producing ladies' shawls and cloaks of separate materials arranged and secured with their inner surfaces together, admitting of the reverse sides being folded over or outwards, as required, the ends being left unsecured for that purpose, and edgings or trimmings corresponding to the same employed in like manner. *Patent abandoned.*

2686. F. WATKINS. *Improvements in apparatus for milking cows.* Dated October 4, 1862.

For the purposes of this invention four elastic flexible teat cups, made of vulcanized india rubber, are used to receive the four teats of a cow. The lower ends of these teat cups are fixed to a hollow ring or vessel. In the centre of this hollow ring or vessel a chamber is formed, over which a flexible dished diaphragm is fixed, the centre part of which is arranged to be moved up and down by a lever handle, the end of which is attached to a disc or plate fixed in the centre of the flexible diaphragm. At the bottom of the hollow ring or vessel is a valve which opens outwards, and below this valve is a spout into which the milk is received as it descends from the hollow chamber or ring to which the flexible elastic teat cups are attached. The hollow ring or vessel and apparatus is supported on a suitable stand, so as readily to admit of the teat cups being brought into position under a cow to receive the four teats. When the flexible diaphragm is moved in one direction, the pressure of air within the hollow ring or chamber is reduced, and the milk is thus caused to flow from all the teats; when the flexible diaphragm is moved in the opposite direction, the milk received into the hollow vessel is forced out therefrom through the valve, the milk ceasing to flow from the teats during the time that milk is flowing from the hollow vessel. The movement of the flexible diaphragm again in the direction first mentioned will again reduce the pressure of air in the hollow vessel, when the milk will again flow into the hollow vessel, and so on, the milk alternately flowing from the teats and then from the outlet spout of the vessel. *Patent completed.*

2687. F. E. BLATSFIEL. *Improvements in diving apparatus, and apparatus to be used for working in deep water.* (A communication.) Dated October 4, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2688. W. CLARK. *Improvements in the means of preserving goods from fire, and in apparatus for the same.* (A communication.) Dated October 4, 1862.

In carrying out this invention, the inventor places the merchandize or combustible materials on small trucks placed on inclined planes in proximity to basins or channels filled with water. When left to themselves, these trucks carry the merchandize with which they are charged into the water, in order to cover them with water, being simply retained in position by means of detents or stops. When a fire breaks out, all the catches are disconnected, which allows the trucks to roll of themselves into the water channels, together with the merchanize. These improvements are especially applicable to stores of wood, tar, or cordage in marine arsenals. *Patent abandoned.*

2689. G. WHICKER and L. BLAISE. *Improvements in skates, and in the method of securing or fastening the same.* Dated October 4, 1862.

Provisional protection has not been granted for this invention.

2690. F. JOHNSON. *Improvements in domestic fire-escapes, and in receptacles for the same.* Dated October 4, 1862.

These domestic fire-escapes are capable of being folded into a small space when not in use, and enclosed in a folding receptacle, the sides and ends of which fall back, and lie flat on the floor on the lid being raised, thus instantly removing all obstruction, and allowing the folding escape to run out through any contiguous opening perfectly free. The folding case or cover is mounted upon castors or runners, and is fitted with handles at the sides, so that it can e easily run or carrird from one room to another; and for ontaining an escape and appliances complete for a five-torey building, only occupies a space of about 30 in. in ength by about 20 in. in width and height. For facilitating the escape of children or invalids, in addition to the folding ladder, there is an invalid bag, the back and floor of which are made to fold, and, when opened out for use, be rigid; the back is attached to the ladder so as to run up and down upon it by means of a rope containing a wire strand, and of sufficient strength to support two adults. This rope is attached to the bag by a spring hook, and the bag secured upon the ladder by projecting flanges at each side, the two ends of which flanges are connected by a chain which passes at the back of the ladder. At each end of the ladder the patentee fits a length of tested block chain or wire rope terminating with a ring or spring snatch-hook; the bottom chain is intended for securing the ladder at the level of the ground at a suitable distance from the building, or at any required angle vertically, while the chain at the top of the ladder is intended for securing it to the wall of the room or apartment, between which and the ground, or between which and any other floor, the establishment of a communication is required. The wall hook, which forms part of the apparatus, consists of a bolt, at one end of which a spring hook is formed, the other end being screwed and fitted with a plate and tightening nut. These wall hooks it is proposed to fix in the wall, inside the building, immediately under the windows or openings of the upper floors. *Patent completed.*

2691. W. TAYLOR and S. BUCKLEY. *Improvements in machinery for preparing cotton and other fibrous materials.* Dated October 4, 1862.

This invention is applicable, first, to openers, blowers, and other machines of the like nature, in which drums or beaters are employed to act upon the fibrous materials. In performing the invention, the patentees make use of a hollow drum or cylinder, provided with slots for toothed or plain blades of steel or other metal to enter between. These blades are attached to bosses loose on a shaft, which shaft is eccentric to and connected with the hollow drum or cylinder, so that, when rotatry motion is communicated to the shaft, the drum revolves also, and the blades are caused to project beyond and enter within the slots. By this arrangement, the fibres presented by feeding rollers or otherwise to the drums are acted upon by the toothed or other blades, and effectually opened and cleaned. Secondly, a similar arrangement of parts is also applicable to carding engines for stripping the fleece of fibres from the surface of the doffer. Thirdly, in order to keep the apparatus clean, they apply a rotary clearer or an endless band to the surface. The clearer is applicable to other apparatus for stripping the doffer. *Patent completed.*

2692. R. PAGE. *Improvements in stables and stabling, applicable in part to kennels and to the floors of fish-houses.* Dated October 6, 1862.

Here the patentee makes waterproof or non-absorbent floors for stables or kennels (and fish-houses) by the use of an artificial stone or composition, consisting of the substance known as Portland cement, combined with fine sand and fine shingle, also finely-powdered clinkers from furnaces, which have been comminuted by grinding or pounding. *Patent completed.*

2693. T. KEECH. *Improvements in floating batteries.* (A communication.) Dated October 6, 1862.

This invention consists in the employment in combination with any kind of ships' hull or body of a floating turret, so arranged as to float in water, or any other suitable fluid contained within the ships' hull, or in a compartment formed therein, and be readily rotated by machinery in the turrets. The invention also consists in forming a communication between the inside of the ship and the inside of the turret by a suitable passage way through hollow frames which sustain the central shaft and through the said shaft, as described. And the invention further consists in a novel arrangement of the guns on curved railways. *Patent completed.*

2694. J. and W. BRADBURY. *Certain improvements in carding engines.* Dated October 6, 1862.

This invention relates to that portion of the carding engine used for carding cotton or other fibrous substances known as the doffer, and consists in the peculiar arrangement and combination of two grooved cams with double bell crank levers for giving motion to the doffing comb. The doffing comb is secured at its extremities to the levers, the grooved cams acting upon the extremity of the vertical part of the levers, and the third extremity opposite to the doffing comb serving as a balance. The lever is made adjustable (so as to set the comb) in the middle of its horizontal length; that is, immediately beneath the vertical part of the lever. The chief feature in the invention is the use of grooved cams having anti-friction bowls running in them, and combined with the double bell crank levers, in contradistinction to the use of face cams or eccentrics, and connecting rods to connect the vibrating levers with them. The invention effects a considerable improvement upon the doffing motion so constructed. *Patent completed.*

2695. D. LOWE. *Improvement in the manufacture of door bolts and latches.* Dated October 6, 1862.

This invention consists in the methods hereinafter described in making the barrels and plates of the said bolts. In making the barrels and plates, the patentee takes a piece of sheet iron of the length of the plates, and by dies, stamps, or presses, he raises along the middle of the sheet an arch which constitutes the barrel in which the bolt slides. Portions of the said arch are at intervals bent in opposite directions, and constitute bands which hold the bolt in the arch or barrel. A narrow band at the end of the barrel is less depressed than the others, and constitutes the top of the bolt. Or, in place of a continuous barrel, he employs one, two, or more separate arched bands in which the bolt slides, and he fixes the said arched band or bands to the plate by turning the edges of the plate over the ends of the said arched band or bands. The improvement in the manufacture of latches consists in the method hereinafter described of making the plates of the latches, and in making and working the lever or latch. He makes the plates of the latches by dies and stamps or presses in a way similar to that by which he makes the barrels and plates of bolts; that is, he cuts and raises from a sheet of iron the strap or guard under which the lever or latch works, and also perforates the plate for the axis of the latch. Or he makes the said strap or guard from a separate piece of sheet iron, and fixes it to the plate by turning its ends over the edges of the plates. When the latch turns upon a centre in the plate, he makes a projecting hollow axis on the end of the latch by means of a press or stamp, and causes the latch to be held down by means of a coiled spring. When the latch turns upon a centre in the strap or guard, he causes the latch to be held down by means of a spring coiled around its axis. *Patent completed.*

2696. S. HOLLAND. *Improvements in machinery for the manufacture of bricks, drain, sanitary, and other pipes, tiles, quarries, and other articles of like manufacture, made from clay, marl, and other plastic substances.* Dated October 6, 1862.

This invention consists, essentially, in forcing the column of clay or other plastic substance through dies for the manufacture of bricks, pipes, tiles, and other articles of like manufacture, by hydraulic pressure. *Patent completed.*

2697. W. CLARK. *Improvements in articles of clothing.* (A communication.) Dated October 6, 1862.

This invention consists, essentially, in applying an elastic gusset to trousers, drawers, and other similar articles of clothing. *Patent abandoned.*

2698. J. NEWNAM. *Improvements in apparatus for crystallizing and for evaporating.* Dated October 6, 1862.

This invention was described and illustrated at page 308 of the present volume of this journal. *Patent completed.*

2699. T. BEARDS. *Improvements in machinery for cultivating land.* Dated October 6, 1862.

This invention consists essentially in combining with a rigid running frame two rising and falling end frames carrying ploughs, grubbers, and cultivators, by which the several operations of ploughing, grubbing, and cultivating may be separately performed. *Patent completed.*

2700. S. F. COX. *Improvements in washing and tanning hides and skins.* Dated October 6, 1862.

The patentee claims so suspending or fastening hides or skins within a rotating frame, that they shall alternately roll or fold up, and again straighten, whilst immersed or partially immersed in fluid. *Patent completed.*

2701. A. V. NEWTON. *Improved apparatus for drying grain.* (A communication.) Dated October 6, 1862.

The documents relating to this invention cannot at present be seen, an extension of time for filing the final specification having been petitioned for.

2702. C. CHINNOCK. *Improvements in the construction of axle-boxes.* Dated October 6, 1862.

The chief object of this invention is to remove or neutralize the friction that is now commonly created between the axles and axle-boxes of carriages, caused by the lateral pressure of the wheels against the collars or shoulders of the axle. This the patentee effects by coupling together the axle and axle-box, by means of antifriction balls, in such a manner that, where a cap is used for closing the axle-box, the connection may be readily made and also maintained on the temporary removal or displacement of the cap without risk of the antifriction balls dropping out of place. By a modified arrangement, he is enabled to provide against the displacement of the balls on the removal of the box itself from the axle. *Patent completed.*

2703. J. HEAP. *Improvements in screw stocks and dies.* Dated October 7, 1862.

This invention consists in making screw stocks of one piece, having dies, one or both furnished with a tail screw on which is a nut fitting in a concave recess in the screw stock, as hereinafter described. The dies are portions of cylinders, or of other suitable shape, and have V-grooves fitting on similar projections in the screw stock, which is made in the form of a fish belly at the centre to combine strength with lightness, and to reduce labour in constructing. The centre portion of the slot in the screw stock is enlarged to allow the dies to be put in their places and removed. The dies may be made of cylindrical pieces of steel, which are screwed into the screw stock; each die may be provided with three cutting recesses for securing bolts or other articles of different diameters. *Patent completed.*

2704. J. SMITH. *An improved screw linchpin for carriages and agricultural implements.* Dated October 7, 1862.

This invention consists in making an aperture in the linchpin large enough to receive a screw; a hole is then drilled from the end of the arm up to the linchpin, and the screw is then applied and fixed in the aperture of the linchpin. This arrangement prevents the possibility of the linchpin falling out. *Patent abandoned.*

2705. W. ASTON. *Certain improvements in the manufacture of buttons for ladies and gentlemen's wear.* Dated October 7, 1862.

This invention consists—1, In adapting revolving beds or tables to the process of fixing together and closing the parts necessary in making covered buttons, such beds being divided, turned, and simultaneously put in motion by a suitable mechanical arrangement. 2, The improvements consist in the application to buttons covered on the edge and faced with suitable woven fabrics of a circular or other shaped metal front, smaller than the general diameter of the button, so as to show a covered edge around the metal part. *Patent abandoned.*

2706. J. OXLEY. *Improvements in apparatus for expressing and separating beer from yeast or barm.* Dated October 7, 1862.

This invention consists in the combination of perforated plates or boards or wire screens with cells or bags of cloth, into which the semifluid substances are forced by means of a pump, the pressure applied to the same being sufficient to express the liquid through the cells or bags, whence it passes through the perforations in the plates or boards, or the spaces between the wires of the screens, into the receptacle required. *Patent abandoned.*

2707. F. RAHLES. *An improved safety envelope.* Dated October 7, 1862.

This envelope the inventor can make to resemble—in so far as relates to the appearance of the back thereof—the ordinary envelope, though he does not open the envelope by moving a flap or flaps at the back as usual. The flaps at the back have a part of the envelope as large as the front of the envelope underneath them, so that, when these flaps are removed, the inside of the envelope has still to be got at by opening this under part. There is a flap at one of the ends of the envelope in front thereof (by preference the right hand end), which flap he prefers to make as perforated net work, or open work, or notched out at the edge, and he applies to the said flap the gum or adhesive compound for fastening the envelope. To the edge of the other part of the envelope to which the said flap is to be fastened, he can apply, if necessary, a coloured composition, or a stripe of any kind, which shall (if desired), upon the flap having been once fastened thereto, and after wards removed, show, by discolouration or otherwise, that violation has taken place. Around two of the edges, and the end opposite the opening flap, is a small cord, the two ends of which are left slightly protruding close to the opening flap, by pulling which cords the envelope will be cut open, when it has to be opened by the recipient thereof in the proper way. *Patent abandoned.*

2708. A. Forbes. *Improvements in connecting together parts of vessels formed of tin plate, and in the means or apparatus employed therein.* Dated October 7, 1862.

The object of these improvements is to facilitate the connecting together of the top and bottom plates or covers to the bodies of cans for holding preserved provisions, as also of similar parts of vessels formed of tin plate for other uses. The patentee forms the outer end or edge of the body of the can or other vessel, or that part to receive a cover, somewhat enlarged, or of a socket form and bell-mouthed, by swaying or otherwise, and he forms the top or bottom (as the case may be) with a turned-up edge, somewhat bell-shaped or inclining outwards, so that its outer edge, when pressed into the socket of the body, may press close to the inside thereof, and leave a groove or channel above for solder. The solder he applies in or over the channel in a ring or other form, adapted to the shape of the vessel, adding resin or other suitable flux to facilitate union of the parts on the application of heat thereto. And then, in place of a soldering iron, he applies the heat to the whole of such surface by means of a heated metal ring or frame, with a groove therein adapted to one part of it, embracing the whole of the side surface, and the other the top edge of the parts to be connected. And to avoid interfering with the soldering already effected of the parts of the body near the top or bottom by the heat of such ring or frame, he cuts a notch or groove in the ring or frame at such part, or he applies over such already soldered part a small piece of paper. *Patent completed.*

2709. J. D. and A. P. Welch. *Improvements in machinery for blocking and pressing hats and bonnets.* Dated October 7, 1862.

In carrying out this invention, the inventors propose to mount on four vertical iron or wooden standards, an iron table, which may be formed hollow, in order to admit of its being heated by steam, hot water, or other medium, if desired. The elevation of the standards is to be continued above the level of the table, for the purpose of serving as guides, within which a dome or hemisphere of iron or other metal is adjusted. This dome is provided at its periphery with four equidistant slots or grooves, which take into the edges of the guides, whereby the dome is retained in a horizontal position or parallel. The lower part of the dome is furnished with a strong diaphragm or disc of india rubber, vulcanized or otherwise, secured in a water-tight or air-tight manner around the entire internal edge or circumference thereof, and the top of the dome receives a tube or pipe, which may be bolted or secured therein, and by which means hot or cold water or air, or other fluid, may be forced into the dome by means of a pump, so as to apply hot or cold hydraulic, pneumatic, or other pressure to the elastic diaphragm. Underneath the dome and diaphragm, and upon the surface of the table, a block or form, either of metal, cement, or wood, of the desired shape or pattern, according to the hat or bonnet to be pressed or blocked, is placed, and, the hat or bonnet being placed thereon, the dome is allowed to slide down between the guides until the diaphragm comes well in contact and encloses the article to be blocked, after which the dome is to be held down by means of clamping screws or other like fastenings, and the hydraulic, pneumatic, or other pressure, is then to be applied from the pump, whereby the elastic diaphragm will be extended, stretched, or forced down on to the outer surface of the hat or bonnet upon the block, and so give it the requisite pressure and shape. *Patent abandoned.*

2710. H. D. P. Cunningham. *Improvements in working the guns and in performing other necessary work on board ships, and in apparatus employed therein.* Dated October 7, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2711. J. K. Hampshire. *Improvements in machinery or apparatus for washing coal, coal slack, and other mineral substances, and in separating foreign particles therefrom.* Dated October 7, 1862.

This invention consists—1, in the application of a pair of toothed rollers for reducing the coal or other mineral substances to be operated on to a uniform size, as nearly as may be, before being introduced into the washing apparatus, which facilitates the washing operation, and the separation of the foreign, extraneous, or refuse matter, from the coal or matters being washed. 2, in the application of an oscillating plate or surface for the agitation of the water to produce the washing operation; 3, in the application of a series of metal grate bars, for the support of the materials being washed, so arranged as to permit the water to act with great force on the material being washed, and so as to admit of, and provide for, the escape thereof after a sufficient treatment in the washing or purifying chamber; 4, in the arrangement for the removal or passing away of the impurities separated from the coal or other minerals being washed. In washing coals and other minerals which are operated on in large quantities, the patentee provides suitable rails or ways and trucks to bring the minerals to the machine, at such an elevation that the materials may be allowed to descend and pass through the several operations, and then be received in trucks placed on rails or ways at a lower and suitable elevation, and be conveyed away to the heap or other store or depository. *Patent completed.*

2712. J. and M. A. Beale. *Improvements in the preparation or manufacture of manure.* Dated October 7, 1862.

This invention consists in manufacturing manure from night soil, lime, soot, common salt, and dregs of asafœtida combined in certain specified proportions. *Patent completed.*

2713. A. V. Newton. *Improvements in the construction of condensers or coolers.* (A communication.) Dated October 7, 1862.

This invention consists—1, in forming a surface condenser or cooler by placing on the outside of the submerged surface of the steamer one or more thin and flat passages, with parallel sides, containing the steam to be condensed or water to be cooled, a lamina of the water in which the vessel floats being interposed between the passages. By this means a form of condenser or coolor is obtained that will offer but little obstruction to the passage of the steamer through the water. The second part of the improvement consists in forming a surface condenser or cooler by placing on the outside of the submerged surface of the steamer a system of tubes with headers, elbows, and return bends, arranged one behind the other, so as to cause little obstruction to the passage of the steamer through the water, and at the same time to allow sufficient water to flow around the tubes to condense the steam or cool the injection water. The third part of the improvement consists in placing a guard around the condensers or coolers, so that they may not be injured by striking against any object. The fourth part of the improvement consists in so arranging a surface condenser that condenses the steam of a steamer, or a cooler that cools the injection water, that they may be disconnected from the engine, and used for the purpose of distilling fresh water from the sea water, and also that they may be readily cleaned. *Patent completed.*

2714. C. F. Terry. *Improvements in machinery for propelling vessels.* Dated October 8, 1862.

This invention consists in the combination of water cylinders and pistons, or a revolving screw, driven by a suitable engine or engines, with water channels leading from the cylinders, or the tube containing the screw to channels at the lower part of the vessel, parallel with the keel, and valves or taps for opening the communication between the water cylinders or the tube containing the screw and the last-mentioned channels for propelling forwards or backwards respectively, such valves or taps being under ready control by means of suitable mechanism for working them as required. The water cylinders or the tube and screw are fixed in or about the centre of the length of the vessel, on each side of the keel, with the valves for admitting the water at such parts of the cylinders, or in such positions with relation to the said tube, as will cause the water driven forwards by the action of the pistons, or of the screw, to pass along the channels leading respectively to the stem or stern of the vessel by the opening of their respective taps or valves. By this arrangement of the parts, the motion of the vessel can be regulated by means of the mechanism for opening and closing the said taps or valves. There are also valves for closing the channels against the admission of water when it is intended to dispense with the use of the propelling machinery above described. *Patent completed.*

2715. D. Nickols. *Improvements in machinery or apparatus for measuring and registering lace and other similar articles.* Dated October 8, 1862.

This invention is carried out as follows:—On a frame of any suitable metal or material, the inventor arranges the necessary rollers or bars, over and under which the lace or article to be measured and registered passes, the diameter of the middle roller being regulated so as to give the measurement required. On the end of the said middle roller is fixed a worm which works into a pinion on the end of a shaft, on which shaft are placed a number of toothed wheels, varying in diameter so as to form a toothed cone. Over the said cone is placed another shaft, with a loose toothed wheel working into the said cone, which can be placed at such a position as to work on any desired part of the cone to measure and register the distance or length required, which is ascertained by a graduated scale fixed on the framework near the said moveable wheel. At the other end of the said shaft is fixed a lever, with a weight or hammer at the other end of it, which lever passes the frame transversely, and is caused to rise and fall at the time the required measurement is made; and on the said transverse lever is placed a marker, which, as it descends, will pass through the material, and, by descending into a small reservoir of colouring matter, will mark the material as it ascends; or, instead of the said marker, a simple marker without colouring matter may be used. *Patent abandoned.*

2716. W. C. Burden. *Improvements in mechanism for giving the pitch or tone required in tuning musical instruments, and also the key note of vocal music.* Dated October 8, 1862.

This mechanism is designed for the purpose of enabling any person to tune musical instruments without the necessity of laying what are termed the bearings, thereby simplifying the operation, and lessening the time necessary for performing it. By this invention also the key note of any vocal music can be obtained. The inventor constructs a framework or box of suitable size and dimensions, of wood or other material, in which he places an opening in any suitable place or position, over which he stretches leather or other flexible material, so as entirely to close the said opening. In the interior of this framework or box he fixes vibrators, and on the exterior, and immediately over these vibrators, are valves or keys sliding in grooves, for the purpose of producing the tones and half-tones of the chromatic scale. A small aperture is made in the framework or box in which is inserted a mouth-piece or tube made of flexible or other material. When wind is forced into the interior of the framework or box through the mouth-piece or tube, and the valve or key of the tone or note required to be produced having previously been opened, the vibrators will produce the tone or note desired. *Patent abandoned.*

2717. T. Ratcliffe. *Certain improvements in looms for weaving.* Dated October 8, 1862.

This invention relates to such looms as are employed for weaving lenos or other similar fabrics, and consists—1, In an arrangement of apparatus for effecting certain movements of the healds. In weaving leno two or more sets of healds are required, one behind the other; and the invention consists in the employment and use of one pulley above and below the healds, and attached thereto, and so arranged that, when the front healds are raised the back healds are lowered in a line with the ways, which is effected by suspending the cone pulleys of the back healds from the pulleys of the back by means of straps, so that as the strap coils and uncoils upon the pulleys, the healds will be raised or lowered. By this means the springs to draw down the healds, as hitherto employed, are dispensed with, except the one attached to the loose heald, which is worked by the middle heald by attaching them together with a cord. A second part of the invention consists in a simple arrangement of levers actuated by a cam on the tappet shaft, to regulate the lifting off of the warp, the cam effecting the temporary yielding of the warp. *Patent completed.*

2718. P. Clavel. *Improvements in the treatment of violet colours derived from coal-tar oils.* Dated October 8, 1862.

This invention consists in an improved mode of treating the violet colours derived from coal-tar oils with a view to render them soluble in water. Over the violet matter to be treated, placed in a suitable vessel, is poured in small quantities at a time a sufficiency of cold fuming sulphuric acid of Nordhausen to effect the solution, the mass being constantly stirred. After being left to repose for about half an hour to complete the saturation, the solution thus formed is poured carefully into a vessel of enamelled iron, or other like suitable resisting material, previously charged with water, heated to from 160 to 212 deg. Fah. The whole is then exposed for a few minutes to the action of a current of steam, after which it is left to cool. The precipitation of the violet colour is then effected by the addition of chloride of sodium, or an earthy alkali, after which the mass is again heated by a current of steam, and maintained in ebullition for about half an hour. During this process the whole of the colouring matter is thrown down, and being collected on a filter is washed with cold water, until all traces of acid or alkali have disappeared. The product thus obtained is thoroughly soluble in hot water, and may be employed in the ordinary way for dyeing or printing purposes. *Patent abandoned.*

2719. J. R. Harris. *Improvements in propelling vessels.* Dated October 8, 1862.

This invention relates to giving motion to vessels by means of propellers enclosed within the body of the vessel, except at the parts of such propellers for the time acting on the water for the purpose of propulsion. The inventor forms the propellers with radial or other suitably formed floats or boards, and enclosed sides, so that the space between the adjoining floats or boards may form chambers, open only at the periphery for action upon the water, and he encloses these propellers, except where they act directly upon the water, within boxes or compartments formed for them in the hull of the vessel. By these means only the part of the propeller for the time acting projects from the vessel, and at the same time the back action of the water is avoided. *Patent abandoned.*

2720. M. A. F. Mennons. *Improvements in self-inking hand stamps.* (A communication.) Dated October 8, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2721. H. Dullens. *An improved runner or fastening for umbrellas, parasols, sunshades, and other like articles.* Dated October 9, 1862.

This improved runner is formed with a rotating collar or ring, grooved and notched to receive the stretchers. By the introduction of this rotating collar upon the runner the latter can be turned to any required position upon the stick, without twisting the frame, and thereby a simple fastening, consisting of a small pin, stud, or screw, can be substituted for the old spring catch at the top and bottom of the range of the runner, or the space it travels upon the stick when opening and closing the frame. In the old plan a long deep groove had to be cut in the stick, thereby materially weakening it at both extremities of the runner's path. This is entirely dispensed with by the improvement here described. At each end of the improved rotating runner the inventor forms a swell or enlargement of the tube, with a number of notches or openings. When the frame is open or closed, the pin, stud, or screw in the stick at the top or bottom, as the case may be, passes into the swell or enlargement at the top or bottom of the runner through one of the openings, and then a partial turn of the runner secures it in the required position. *Patent abandoned.*

2722. J. Maurice. *Improvements in steering ships or vessels, and in the apparatus to be employed for that purpose.* Dated October 9, 1862.

This invention consists in substituting for the ordinary rudder, or as an auxiliary thereto, a sliding, traversing, vibrating or partially rotating surface of metal or wood, mounted or fitted so as to work within a sheath or case, and capable of being projected into the water from the ship's sides, port or starboard, according to the required change of the ship's course. *Patent abandoned.*

2723. W. Bush. *Improvements in cannon and small arms.* Dated October 9, 1862.

This invention is designed chiefly for guns for ships and batteries, but it applies to all other guns, large and small. It consists in forming the gun in two parts—one the barrel for containing the projectile, the other the breech and chamber for containing the powder; in uniting the two parts by means of a screw or screws, as hereafter explained; and in connecting the breech and chamber to a slide, in such manner that when the breech is disengaged from the barrel, it can be turned down, as upon a hinge, for the purpose of charging the barrel and chamber. The inventor forms, say, the male screw on the rear of the barrel, and the female screw on the inner and fore end of the breech chamber; he cuts away or forms channels in both male and female screws, to allow of the chamber being slidden along the rear end of the barrel, when, by a partial turn of the chamber, the two parts become locked by the engagement of the screws. He grinds the rear end of the barrel and the seat for it in the chamber, and, if necessary, uses a washer to keep the parts gas tight. In some cases he screws a steel tube into the rear of the barrel. *Patent completed.*

2724. C. N. Wilson. *Improvements in rag-machines.* Dated October 9, 1862.

This invention consists in giving to the cylinder or swift, or to the feedr ollers of rag-machines, reciprocating motion, in addition to the usual rotary motion, thereby producing lateral as well as direct action upon the rags, fabrics, or fibrous substances acted upon. *Patent abandoned.*

2725. J. H. Johnson. *Improvements in polishing precious and other hard stones, and in the machinery or apparatus employed therein.* (A communication.) Dated October 9, 1862.

This invention relates to an improved mode or method of polishing pieces of rock, containing jasper, pure jasper, and other precious and hard stones, and consists, essentially, in the polishing of such substances without the intervention of polishing powders or substances of any kind between the wheel and the stone under treatment. The polishing wheel is composed of fine grit stone, and the dust powered is produced from the stone by a ventilator or brush slightly wetted being occasionally applied to the wheel for the purpose of preventing it from over-heating. *Patent abandoned.*

2726. J. H. Johnson. *Improvements in the manufacture of paints or pigments.* (A communication.) Dated October 9, 1862.

The patentee claims—1, The manufacture of paints or pigments, having a base of powdered galvanic copper, or of powdered copper which has been in a state of fusion. 2, The manufacture of paints or pigments having a base of benzole mixed with resinous, gummy, asphaltic, or bituminous matters, before being incorporated with the oils and metallic oxides, carbonates, or sulphides, such paint possessing all the varieties of tone and colour before its admixture with the before-mentioned metallic oxides, carbonates, or sulphides. 3, The application of these paints or pigments to all surfaces heretofore covered or coated with paint. *Patent completed.*

2727. R. Hammond. *Improvements in armour for ships of war.* Dated October 9, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2728. A. V. Newton. *Improved machinery for breaking and cleaning flax, hemp, and other like fibrous substances.* (A communication). Dated October 9, 1862.

This invention relates to a novel arrangement of machinery for breaking and cleaning flax, hemp, and other like fibre-yielding plants. It is also capable of being beneficially applied to the softening of fibres after they have undergone the scutching operation. The machine consists, mainly, of two pairs of gripping fluted rollers, which are operated in such a manner that the woody portion of the material under treatment is broken by a crushing action, and the broken fragments loosened from the fibres by a rubbing action of the flutes alternately in opposite directions. *Patent completed.*

2729. J. B. Palser. *Improved apparatus for manufacturing paper pulp and recovering the alkali used in such manufacture.* Dated October 9, 1862.

The object of this invention is to reduce straw and other fibrous materials to pulp in an economical and expeditious manner. The process may be simply described as the subjecting of straw and other fibrous materials to the action of an alkaline solution in rotating boilers under a pressure of from 110 lb. to 130 lb. to the inch, or thereabouts. The invention cannot be described without reference to the drawings. *Patent completed.*

2730. G. Simons. *Improvements in the manufacture of plates, rods, axles, tyres, and other articles that are required to be partly of iron and partly of steel.* Dated October 9, 1862.

The object sought to be accomplished by this invention is the manufacture of steel and iron united intimately to each other; but this, from the nature of these metals, is impossible when one of them is welded to the other. The inventor states that he has attained this object by the application of the principle of partial cementation. By conducting the cementing process in the manner described in the specification of this invention, plates and bars, both round and square, and other articles, may have one or more or all of their faces, or a part or the whole of their circumference, steeled, the other faces or the interior of the articles not having been at all subject to the carbonizing action. *Patent abandoned.*

2731. L. Hosch. *An improvement in the mode of constructing travelling trunks and portmanteaus.* Dated October 10, 1862.

In carrying out this invention, the inventor takes two thin sheets of suitable wood and glues them together, applying a sheet of canvas or other suitable materials between them, taking care to cross the grain of such wood, and this forms the cases of the shapes required. *Patent abandoned.*

2732. W. and S. Scholefield. *Improvements in apparatus for cutting button holes and other similar purposes.* Dated October 10, 1862.

In carrying out this invention, the inventors make an apparatus working on a pivot the same as the ordinary scissors or shears, but instead of the two blades cutting by the edges coming in contact, they fix a knife at the extreme point of the upper part of the cutters, making the said knife any suitable length, with a small tube at one end of it for the purpose of cutting or rounding the hole at the front end to receive the shank of the button. The said knife is secured to the upper part of the apparatus by set screws, whereby the inventors are enabled to adjust or regulate it as required when it becomes worn, or to take it out for the purpose of sharpening. At the end of the bottom part of the cutters they make a slot and fix a guide to work in it, which is adjusted to the length required by means of a graduated scale on the said guide, and when set to the proper length is secured by a screw, so that all the holes will be cut of the same length. And in addition to the guide they place or fix another guide or gauge with a stop or projection to regulate the distance required from the edge of the material to be cut. *Patent abandoned.*

2733. E. R. Green and J. Cockcroft. *An improved amalgamation of materials forming a substance suitable for printers' blankets, conductors used in paper making, packings for joints, and similar purposes.* Dated October 10, 1862.

In carrying out this invention, the patentees combine two or more lengths of paper, together with a solution of india rubber, or its substitutes, by spreading it between them and pressing them together. Or they put a texile fabric, such as linen, cotton, or woollen, between folds of paper; or they put a texile fabric, such as linen, cotton, or woollen, on the outside, with paper underneath, always making the different folds adhere with a solution of india rubber, or its substitutes, as above. In selecting the "surface" of the article to be used for printers' blankets, it must be adapted to the peculiar colours used by the printer, as some colours are strongly acid, some alkaline, others neutral. For the webs used by paper makers they prefer to use folds of woollen paper, with a textile fabric at the back. For washers for packing for steam joints, they join any suitable number of any of the above materials together, and submit them to pressure and heat or other drying process. *Patent completed.*

2734. G. Baguley and H. Greener. *An improved construction of insulator for telegraph wires.* Dated October 10, 1862.

The object of this invention is to secure telegraph wires in position on or in their insulating supports without wire bindings or other attachments as commonly employed. This the inventors effect by forming the insulator with a longitudinal slot for receiving the telegraph wire, and they gain access to the slot for the insertion of the wire by making a zig-zag opening in the side thereof. By this arrangement the tendency of the wire (through the continued action of the wind upon it) to escape from its seat is completely checked. *Patent abandoned.*

2735. J. Lowe and J. Harris. *An improved construction of propeller.* Dated October 10, 1862.

The object of this invention is to economize the power applied to the driving of ships' propellers. This result the patentees obtain by so modifying the form of the blades of the class of propellers that are known as screw propellers, in contradistinction to paddle-wheel propellers, as to prevent the churning of the water near the centre of motion, and at the same time to effect a reduction of the slip of the propeller, and of the vibration of the propeller shaft. In carrying out this invention, they use two, three, or more radial blades, and these blades they shape so that when viewed edgewise or endwise, instead of forming portions of the thread of a screw, they will present a curved line curling in opposite directions from the centre to the edges of the blade. *Patent completed.*

2736. H. A. Marinoni. *Improvements in apparatus for fixing type in the chases.* Dated October 10, 1862.

This invention consists in the arrangement and application of wedge or inclined pieces or quoins having rack teeth, forming thereon and fitting into a pinion or cylinder having indents to receive the teech of the rack. This wedge with rack teethis placed and abuts against the foot and sidestick or furniture and type, and the patentee disposes the cylinder between such rack, wedge, or quoin and the chase. The pinion cylinder has small inclined flanges embracing the chase to keep it in place, as also the quoin; a square hole is made in the centre of the pinion cylinder for the insertion of the key whereby to turn it. The pinion cylinder is also furnished with bearing surfaces, which bear and roll on the plain surfaces of the chase and on the quoin. By turning this cylinder it is propelled and rolls on the quoin and rubs along the chase by reason of the grip of the pinion on the rack teeth of the quoin, and in passing from the thin towards the thick part of the quoin, wedge, or inclined piece with a gradually increasing pressure locks and fixes the furniture and type firmly in place in the chase. *Patent completed.*

2737. W. C. Edge. *Improvements in velocipedes.* Dated October 10, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2738. D. S. Sutherland. *Improvements in constructing beams, girders, bridges, and viaducts.* Dated October 10, 1862.

The object of this invention is the construction of a beam, girder, bridge, or viaduct that shall be self-contained, while retaining the distinctive features of a suspension bridge, that is to say, the power exerted by means of the anchorage or otherwise in the maintenance of a suspension bridge is applied and diverted by the patentee in another form and direction, viz., within the structure itself. He effects this by means of a combination of compression or straining beams, and of suspension bars or tension rods. *Patent completed.*

2739. W. Weallens. *Improvements in surface condensers for marine and other engines.* Dated October 10, 1862.

This invention consists—1, in screwing one or both ends of the condenser tubes externally or internally, so as to admit of a screwed nut or cylinder of brass or other material to be screwed on or into one or both ends of such tubes, india rubber or other elastic material embracing the tube ends being introduced between the tube plate and the said nut, a recess being made in the tube plate to receive the same. The object of the second part of the invention is to effect the most advantageous distribution of water through the various tubes of surface condensers. The cold water chamber, into which the water is forced before going through the condensing tubes, is divided into two or more parts by division plates arranged at right angles, or nearly so, to the condensing tubes. These plates can be adjusted so as to increase or diminish the volume of water at any part of the condenser by means of screw levers or other mechanical appliances from the outside of the said cold water chamber where the condenser is in operation. *Patent abandoned.*

2740. T. Anderson. *Improvements in the construction of ships or vessels.* Dated October 10, 1862.

Under one arrangement, as adopted for a passenger ship or for carrying freight, the improved vessel consists of two hulls arranged parallel, the inner face of each hull forming a vertical line, in the same manner as if an ordinary hull was cut asunder longitudinally, and the open part of each half was shut in by a level facing of timber. These hulls are arranged at some distance asunder, and are connected together by a deck above, on which is built another, and the sides are enclosed in the usual way; the area thus obtained is of great extent, and may be fitted up with cabins, or set apart for cargo. The lower part of each hull may also be usefully employed for the stowage of freight, stores, or other similar purpose. In the broad longitudinal channel formed between the two hulls is fitted a central paddle wheel, and outside the hulls are fitted two other paddle wheels in the ordinary position. These propellers may be used either conjointly or otherwise, according to the speed at which the vessel is required to be driven. At the fore part of the vessel is built a cutwater, which is pendent from the underside of the lower deck. In passengers vessels the central part of the upper deck is occupied by a saloon, the elevated position of which affords every facility for admitting abundance of light, and obtaining complete ventilation, whilst the space outside forms an excellent promenade owing to the great width of the deck. *Patent abandoned.*

2741. J. J. Shedlock. *Improvements in gas meters.* Dated October 11, 1862.

In order that a wet gas meter may be rendered the more sure and perfect in its registration, the patentee surrounds the drum or measuring wheel with an annular float or air-tight vessel of sufficient capacity to displace a volume of water equal in weight to the drum, so that by possessing a buoyancy it can rise as the water rises, or fall as the water decreases in the case; or, more properly speaking, that the water always maintains the same level in the drum or measuring wheel. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Dec. 22, 1862.

3414. A. S. Stocker, Wolverhampton, manufacturer. Improvements in rolling iron for the manufacture of tips and other articles.

Dated Jan. 15, 1862.

127. H. Turner, Leeds, leather strap manufacturer. Improvements in apparatus for preventing and curing blight, decay, disease, and rot in potatoes.

Dated Feb. 18, 1862.

450. J. Gray and J. Hudson, Botolph-lane. Improvements in the treatment of steatite, and in its application to certain purposes.

Dated Feb. 24, 1863.

496. H. Masters, Bristol, architect and civil engineer. Improvements in spools, bobbins, rollers, and similar articles.

Dated March 3, 1863.

601. J. Pollard, Leeds, commission agent. Improvements in warp dressing, and in apparatus connected therewith. (A communication.)

Dated Nov. 5, 1862.

622. W. J. and R. Watkins, Canal Iron Works, Millwall, engineers. Improvements in steam engines.

Dated March 6, 1863.

637. W. E. Gedge, 11, Wellington-street, Strand. Improvements in steam engines. (A communication.)

Dated March 11, 1863.

667. W. Wood, Monkhill, near Pontefract, York. Improvements in the manufacture and ornamentation of pomfret or liquorice cakes, rolls, sticks, and pipes, and other similar articles of confectionery.

Dated March 21, 1863.

753. I. M. Evans, Cefn Mawr, and W. T. Griffiths, Merthyr Tydvil. Improved means for ventilating mines.

Dated April 7, 1863.

872. J. Swinburne, Alfred Town, Ashford, Kent, and J. Stanley, Whitechapel-road. Improvements in steam engines and generators.

876. J. H. Johnson, 47, Lincoln's-inn-fields. Improvements in machinery or apparatus for drying grain, applicable also to the manufacture of malt. (A communication.)

880. J. Howard, E. T. Bousfield, and J. Pinney, engineers, Bedford. Improvements in steam engines, and in the means of applying the same to the tilling of land, also in apparatus to be used with such engines in the tilling of land.

Dated April 9, 1863.

896. G. Spencer, 2, Lousanne-villas, Queen's-road, Peckham, civil engineer. Improvements in preventing incrustation in steam-engine boilers.

900. J. R. Burton, K.H.A., Vice Admiral in Her Majesty's Navy, 15, Park-square, Regent's-park. A new method of, and apparatus for, cleansing ships' bottoms.

Dated April 10, 1863.

908. S. Shelmerdine, Stockport, and J. Dransfield, Oldham, hat manufacturers. Improvements in the ornamentation by printing of felt hats.

912. J. Gimson, Leicester, engineer. Improvements in screw-cutting lathes.

914. H. Caudwell, Oatlands House, Shillingford, gentleman. Improvements in the construction of vessels of war, part of which improvements is applicable to fortifications.

Dated April 11, 1863.

916. J. Lockwood, Batley, rag merchant. Improvements in steam boiler and other furnaces.

918. W. Samuel, Liverpool, watch manufacturer. Improvements in, or applicable to, railway carriages to mitigate or lessen the effects of collision to passengers.

920. W. Clark, 53, Chancery-lane, engineer. Improvements in separating ores from their gangues, and in apparatus for the same. (A communication.)

922. A. F. Maclure, Glasgow, machinist. Improvements in looms for weaving figured fabrics.

Dated April 13, 1863.

924. J. Ramsbottom, Crewe, engineer. Improvements in machinery for hammering, rolling, and shaping metals.

926. A. Rolfe, Amwell-street, Pentonville, merchant. Improvements in means or apparatus for propelling carriages on railways, tramways, or on common roads..

932. T. Mallinson, Globe Works, Manchester, machine maker, and P. Williams, machinist. Improvements in machinery for opening, cleaning, carding, and grinding or sharpening cards used in preparing cotton and other fibrous materials.

Dated April 14, 1863.

934. G. Berry, 19, Buttesland-street, Hoxton, gentleman. Improvements in locks.

936. W. and J. Keats, Street, Somerset. Improvements in the manufacture of boots, shoes, or other coverings for the feet.

938. J. Keats and W. S. Clark, Street, Somerset. Improvements in sewing machines.

942. J. Smith, Edward-street, Wentworth-road, Bow-road East, engineer. Improvements in furnaces and boilers for the generation of steam, partly applicable also for other purposes.

Dated April 15, 1863.

944. E. P. Colquhoun and J. P. Ferris, 1, Lawrence Pountney-hill. Improvements in fire bars for the purposes of steam boilers and fire grates.

946. W. Clark, 53, Chancery-lane, engineer. Improvements in apparatus for the transport of goods. (A communication.)

948. A. Marriott, High-street, Higham Ferrers, Northampton, engineer. Improvements in boilers for heating buildings, and in regulators for the same.

950. H. Heaton, Manchester, smith and wheelwright. Improvements appicable to presses for baling purposes.

Dated April 16, 1863.

954. J. B. Watts, Birmingham, sword cutler. An improvement in steel sword hilts.

956. I. Baggs, Cambridge-terrace, practical chemist, and W. Simpson, Tovill Upper Mills, manufacturer. Improvements in purifying and treating coal gas, sulphuretted hydrogen, and other gases containing sulphuretted hydrogen, and in obtaining sulphur, sulphuric and other acids in such treatment.

958. S. Moulton, Bradford, India-rubber manufacturer. Improvements in apparatus or means for lessening the recoil of cannon.

962. F. A. E. G. de Massas, Hoxton, civil engineer. Improvements in smut machines, and in machines for cleansing and peeling grain and seeds.

Dated April 17, 1863.

968. R. H. Lawson, Victoria-terrace, Victoria Docks, and W. Darlow, Victoria-place, North Woolwich-road. Improvements in apparatus or means for obtaining motive power.

970. C. Turner, Airedale Felt Mills, Hunslet. Improvements in the manufacture of felted fabrics.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, April 28, 1863.

3353. J. McInnes and E. F. Prentiss. Distillation and treatment of petroleum and other like oils.

3355. G. C. Warden. Ornamenting textile fabrics. (A communication.)

3360. W. Hudson, H. Moore, C. Catlow, and S. Newburey. Looms for weaving.

3361. J. L. W. Thudichum. Collecting human excreta.

3363. R. Schomburg and A. Baldamus. Oils used for illuminating purposes.

3364. H. Jürns. Clocks or timepieces.

3368. C. Defries. Lamps.

3379. G. A. Huddart. Buttons.

3390. J. Savory. Apparatus for the inhalation of medicinal powders. (A communication.)

3399. D. Davidson. Telescopes.

3402. J. B. Morrison. Washing machines. (A communication.)

3411. F. C. Bakewell. Communications by electricity.

3414. A. S. Stocker. Rolling iron.

3417. R. A. Brooman. Heating and drying. (A communication.)

3430. T. C. Hinde. Generating carbonic oxide.

3442. R. Lakin and J. Wain. Doubling cotton and other fibrous materials.

3446. J. H. Johnson. Stamping. (A communication.)

3455. J. Swainson. Manufacture of pill boxes.

3465. F. Tolhausen. Petroleum or coal oil as fuel. (A communication.)

3469. W. Billinghurst and J. Requa. Portable battery.

3477. J. E. Carter. Chimney tops.

3479. W. Clark. Governing apparatus. (A communication.)

13. F. C. Bakewell. Burning oil and other inflammable fluids as fuel. (A communication.)

22. A. S. Bolton. Manufacture of wire

38. H. Chamberlain. Generating and condensing steam and evaporating liquids.

81. W. H. Moreland and J. Chappell. Winding, warping, beaming, or dressing machines.

83. W. Tasker. Harrows.

126. W. Johnson. Manufacture of chlorine and bleaching powder, carbonate of soda and soda ash, and sulphate of iron. (A communication.)

185. W. Clark. Photogenic pictures or representations. (A communication.)

209. C. Stopford. Hats and other coverings for the head.

261. B. J'A. Bromwich. Motive power.

272. A. Pritchard. Preserving the contents of packages from air, water, or damp.

288. F. Tolhausen. Apparatus for cleaning the beams of mules and spinning frames, collecting the dust and waste thereof, and also for cleaning the flooring underneath the mule carriages. (A communication.)

382. W. Clark. Bearing surfaces of shafts and other axles. (A communication.)

500. J. Hawthorn. Handles for doors, drawers, and other means of enclosure.

667. W. Wood. Manufacture and ornamentation of pomfret or liquorice cakes, and other similar articles of confectionery.

725. W. E. Taylor. Machinery for reeling, winding, warping, and beaming yarn.

865. T. Burrow. Machinery for combing or dressing silk, flax, wool, hemp, China grass, and other fibrous materials.

880. J. Howard, E. T. Bousfield, and J. Pinney. Tilling of land.

900. J. R. Burton, K.H. Cleansing ships' bottoms.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed April 24, 1863.

2865. L. Groux.
2889. T. Pilgrim.
2801. J. J. Ridge.
2892. P. E. Placet.
2893. G. Lindemann.
2898. E. Hooper.
2900. E. and A. Tatham.
2903. E. S. Tudor.
2906. T. Sutton.
2907. A. Ripley.
2908. A. Shanks and F. Kohn.
2918. W. E. Gedge.
2922. F. L. Stott.
2926. H. Eastwood.
2927. F. Gregory.
2931. P. Giffard.
2940. D. Spink.
2955. J. W. Taylor.
2962. F. Tussaud.
2966. F. Trachsel and T. Clayton.
2970. T. O. Clark.
2985. J. Shirt and C. Briggs.
3001. J. J. Laveissière.
3010. C. O. Heyl.
3021. E. Sonstadt.
3029. R. R. Holmes.
3049. J. Faulding.
3055. G. W. Rendel.
3065. C. G. Kopisch.
3075. E. Kirby.
267. J. Pouncy.
395. J. A. Schlumberger.
516. H. Wilde.

Sealed April 28, 1863.

2942. C. Gubbins.
2969. W. Clark.
2971. D. Scattergood.
2973. R. A. Brooman.
2974. W. H. Stallard.
2976. J. Lefebvre.
2977. François Durand.
2982. P. W. Reuter.
2983. T. Huntley.
2984. R. A. Brooman.
2988. A. Wall.
2998. J. Petrie, jun., and J. Teal.
3008. J. A. Fullarton.
3013. T. Greenwood and J. Schofield.
3016. H. Kilshaw and E. Lord.
3023. J. and T. Mellodew, and C. W. Kesselmeyer.
3028. S. Berrisford and W. Ainsworth.
3047. T. Bradford.
3051. J. A. Duntze.
3074. L. Croc.
3102. J. Oxley.
3104. H. J. F. Marmet.
3113. G. A. Buchholz.
3143. C. De Bergue.
3165. A. V. Newton.
3241. A. T. Becks.
3241. A. T. Becks.
3314. W. A. Turner.
92. D. Dawson.
162. R. A. Brooman.
184. A. Boubée.
263. T. A. Weston.
411. F. E. Walker.
48[illegible]. A. Dugdale.
579. J. W. Burton.
678. E. H. Lomas.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1008. J. Parkinson.
1017. E. Hillam and R. R. Wilton.
1033. T. A. Claeys.
1042. J. G. West.
1056. W. J. Harvey.
1089. H. T. Green and S. B. Wright.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1211. C. De Jongh.
997. R. Lakin, J. Thompson, E. G. and F. A. Fitton.
1003. C. A. Arnaud.
1006. T. Heiffor.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending April 25, 1863.

No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.	No.	Pr. s.	d.
2543	1	8	2556	0	4	2565	0	4	2574	1	6	2583	0	4	2592	0	4
2547	0	10	2557	0	10	2566	0	8	2575	0	8	2584	1	0	2593	1	4
2548	0	4	2558	0	4	2567	0	4	2576	0	10	2585	0	8	2594	0	4
2549	0	10	2559	1	2	2568	0	4	2577	0	4	2586	0	4	2595	0	4
2550	0	8	2560	0	8	2569	0	8	2578	0	4	2587	0	4	2596	1	4
2551	0	6	2561	0	4	2570	1	0	2579	0	4	2588	0	10	2597	0	8
2552	0	4	2562	1	4	2571	0	6	2580	0	8	2589	0	4	2598	0	4
2553	0	8	2563	0	10	2572	0	4	2581	0	8	2590	0	8	2599	0	4
2554	0	4	2564	0	4	2573	0	4	2582	0	4	2591	0	4	2600	0	4
2555	0	6															

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.		£	s.	£	s.
Teak ...... load	£12	0	£13	0	Archangel, yellow...	£13	0	£13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
„ yellow pine.	3	10	4	10	Finlan	9	0	10	0
St. John, N.B., yellow	5	0	5	10	Memel	10	0	15	0
Quebec oak, white...	5	10	6	10	Gothenburg, yellow	10	0	11	0
„ birch	3	10	4	10	„ white.	9	0	9	10
„ elm	3	10	5	0	Gefle, yellow	10	0	11	10
Dantzic oak	3	10	6	10	Soderhamn......	9	10	10	10
„ fir	2	10	3	10	Christiania, per C., 12ft by 3 by 9 in.				
Memel fir	3	5	3	10	Christiania, yellow	21	0	23	0
Riga......	3	0	3	5	Deck Plank, Dantzic,				
Swedish	2	10	2	15	per 40 ft. 3 in.	0	14	1	4
Masts, Quebec red pine	5	0	6	0	PUMICE STONE pr ton	5	10	0	0
„ yellow pine	5	0	6	0	OILS, &c.				
Lathwood, Dantzic, fm	5	10	6	10	Seal, pale ...per tun	46	0	0	0
„ St. Petersburg	8	0	8	10	Sperm body	82	0	82	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Cod......	48	0	0	0
					Whale, Sth Sea, pale	44	0	0	0
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	58	10	60	0
St. John, white spruce	14	0	15	10	Cocoanut, Cochin...	51	0	52	0
Yellow pine, per reduced C.					Palm, fine	37	0	0	0
					Linseed......	43	15	44	0
Canada, 1st qual. ...	17	0	18	0	Rapeseed, Eng. pale	52	0	0	0
„ 2nd do......	11	0	12	0	Cottonseed	33	10	41	10

METALS.

		£	s.	d.		£	s.	d.	p ct.
IRON:—									
Welsh Bars, in London	per ton	6	10	0	to	6	12	0	2½
Nail Rods	do	7	0	0		7	10	0	
Hoops......	do	8	7	0		8	10	0	
Sheets, single	do	9	10	0		9	15	0	
Staffordshire Bars......	do	7	10	0		8	0	0	
Bars, in Wales	do	5	10	0		5	15	0	
Rails	do	5	12	6		5	15	0	nett
Foundry Pigs, at Glasg. No 1	do	2	11	0		2	16	0	
Swedish Bars	do	11	5	0		11	15	0	2½
STEEL:—									
Swedish Keg, hammered ...	do	16	0	0		0	0	0	
Swedish Faggot......	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts...	do	96	0	0		0	0	0	3
Hammered Bottoms......	do	105	0	0		0	0	0	
Flat Bottoms, not Hamrd....	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8¼		0	0	8½	
Fine Foreign	per ton	94	10	0		95	0	0	
TIN:—									
English Block......	per cwt.	5	19	0		0	0	0	3½
do Bar......	do	6	0	0		0	0	0	
do Refined......	do	6	4	0		0	0	0	
Banca......	do	6	5	6		0	0	0	nett
Straits......	do	6	3	0		0	0	0	
TIN PLATES:—									
Best Charcoal, I.C......	per box	1	8	6		1	9	6	3
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
LEAD:—									
Pig, English......	per ton	20	10	0		22	0	0	2½
„ Spanish Soft	do	20	5	0		0	0	0	
Shot, Patent......	do	23	10	0		24	0	0	
Sheet	do	21	0	0		0	0	0	
White	do	26	10	0		0	0	0	
SPELTER:—									
On the spot	do	18	0	0		0	0	0	nett
ZINC:—									
English Sheet	do	23	10	0		0	0	0	2½
QUICKSILVER......	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	42	0	0		0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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The *Times*, May 7th, speaking of Benson's Watches in the Exhibition, says :—"Undoubtedly, however, the finest show in this respect is made by Benson, who offered prizes for designs for watch-cases at the South Kensington Museum, and who by this means has secured some of the most exquisite ornamental details for watch-cases that are shown in the building." Chronometer, duplex, lever, horizontal, repeaters, centre seconds, keyless, split seconds, and every description of watch, from the plainest to the highest quality of which the art is at present capable, and adapted to all climates. Benson's Illustrated Pamphlet on Watches (free by post for two stamps) contains a short history of watchmaking, with descriptions and prices. It acts as a guide in the purchase of a watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world, to select a watch, and have it sent free and safe by post. J. W. Benson, Prize Medallist, 33 and 34, Ludgate-hill, London.—Established 1749.—[Advt.]

THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 8, 1863.

ANALYSIS OF CAST IRON.

Few subjects present features of greater importance than the best means of obtaining accurate information regarding the constituents of any sample of cast iron. From the ironmaster, who from the crude pig manufactures sheets, rails, bars, the panoply of an armour-plated frigate perhaps, to the civil engineer, the success of whose works may depend on the ultimate strength of columns and girders of cast iron—all are concerned; by all any further progress in the means of obtaining an accurate analysis of a material so largely used, must be hailed as a welcome aid to their labours. Hence, if we regard the subject in this point of view, everything, no matter how apparently trivial it may seem, which tends to throw light on an admittedly difficult subject, must be regarded as of more or less importance. We would call the attention of our readers to a phenomenon which we have found sufficiently obvious, yet has not yet, we believe, received any share of attention from those who might possibly draw valuable deductions from it.

When melted pig iron is tapped into a ladle in moderate quantities, so that excessive heat may not prevent pretty close observation, it will sometimes be found to boil violently, sometimes its surface is calm from the first. Now, if this molten iron is allowed to stand a few minutes until it becomes perfectly quiet, and is then carefully skimmed clean, we shall find that a beautiful irridescence covers its entire surface, due to the constant breaking up of the extremely thin film of oxide formed on the iron. This irridescence, frequently called by moulders the "pattern of the iron," may, on close inspection, be found to consist of a multitude of many sided or rayed stars, in constant motion; breaking up and vanishing, and forming anew with the velocity of thought, and almost eluding the eye. It is a matter of extreme difficulty to determine the number of rays in each figure; we believe we are correct in saying five; one thing is certain that their shape and character, is invariable with every species of iron with which we are acquainted.

This much premised, we would call attention to what we are inclined to consider as a proved fact—namely, that the *size* of the different figures which make up the "pattern," in all cases, depends on the size of grain of the iron when in the pig. Thus, hematite, which is a large-grained iron, will, when melted, present a large pattern. Fine-grained irons, such as the grey forge pig of some of the Staffordshire works, give an extremely small pattern. This distinction is, we understand, so well marked, that in some cases a glance at the melted iron will enable an accurate opinion to be formed as to the size of grain in the pig.

We have already said that it is almost impossible to determine exactly the form of the figures presented by the irridescence. Might not instantaneous photographs be taken, which would give us all the information we require on the subject? We throw out the hint to those skilled in that department of science. We believe it might be possible to obtain photographs from the surface of vessels containing different samples of melted iron, whose comparison might lead to valuable results. As it is, it seems clear that the character of the figures bears some relation, more or less fixed and determinate, to the laws regulating the crystallization of the iron on cooling; and in this belief, without wishing to be understood as making any positive assertion on the subject, we would suggest it to those occupied in scientific research, as one which while certainly not devoid of interest, may in able hands lead to useful practical results.

PAYMENTS FOR THE PROTECTION OF INVENTIONS.

In response to the ill-judged attacks lately directed against patent rights, the question as to the existence or abolition of these laws has been completely brought before the public. The matter appears to us to have been discussed almost *ad nauseam*, as the majority of men of sense have long since made up their minds on the question. In any case, the Legislature would look twice before it abolished a system that has existed for nearly three centuries in our own country, and has been imported into every civilized part of the world.

At the same time, the practical questions touching upon patent right have so many and such varied bearings, that it is important for the interests of inventors that these inquiries should be well ventilated before any alteration is made in the existing law. As is generally known, a Government Commission of eleven gentlemen has been formed to ascertain the best means to remedy existing abuses. Seven out of the eleven persons composing this Commission are lawyers; and when it is remembered that nearly £10,000 are annually drawn by the Crown lawyers from the Patent Fund; and if we bear in memory the enormous incomes derived by the legal profession from disputed patent cases (many patent suits have cost £20,000), it will be seen how important it is for the public interested in patent property to think and act for itself in this matter. Mr. Thomas Webster, the well known patent barrister, has already set patentees a good example. This gentleman lately read a Paper before the Inventors' Institute, "On the Effect of the Periodical Payment, at the end of the Third and Seventh Years respectively, on the Patent System, and Interests of Inventors." The questions touched upon in the Paper were then discussed, in an interesting but somewhat desultory manner, by the members of the Institute. We have not space to treat fully on these inquiries, but it may be interesting to briefly allude to the various plans of payments for patented inventions that have been proposed and carried out in different countries.

These various systems may be divided into three several heads:—1. Gratuitous, or, at least, very cheap patents. 2. One payment for the whole duration of the patent. 3. Periodical and increasing payments; or annuities, either constant, or progressively increasing. Most of the above-enumerated systems are represented in the different countries where invention is regulated by a patent law.

1. In Prussia, in some of the German States (*e.g.*, Hanover), and in Denmark, patents are granted almost gratuitously.

2. In Russia, Spain, Portugal, Sweden, Holland, Bavaria, and in the United States, a single payment is at once required, covering the whole duration of the patent. In no case, however, do these payments at all approach in amount the sums demanded in our own country.

3. In England, in Saxony, and in the Papal States, there are two or three progressive payments spread over the total duration of the patent. The payments in France and in Wurtemberg are made in the form of annuities; in the first country of 100f. per annum. In Belgium there are increasing annuities. In that kingdom 10f. are paid the first year, 20f. the second year, 30f. the third year, and so on till the *twentieth* year, by which time the payment of course amounts to 200f. It would, no doubt, be valuable to our Patent Commissioners to obtain full evidence from foreign countries as to the working of their patent laws. The question, whether an invention should obtain a gratuitous or, at least, a very cheap patent, is one fraught with great difficulties in its solution. It forms a great question by itself, and we have not space to fully discuss it here. Patents have to pass a very severe and stringent examination in countries where this system exists. This examination is so severe in Prussia that its stringency amounts to a positive grievance. With respect to gratuitous patents, we must remember that all property in civilized society is subject to taxation, and there is no reason why patent property should be exceptionally exempted. If the price of patents be much lowered, a Patent Examining Commission would have to be formed to stem the tide of the innumerable resulting applications for patents, and there are many practical difficulties in the formation of a Board of Examiners.

With regard to the second system, that of a single payment, once and for all, it is, perhaps, objectionable, both for the patentee and the public. The patentee has to pay a lump sum, often very heavy in amount, before he has the least protection in his undertaking. If the patentee be unable to carry out his invention; and there is a very great distance, and a long and difficult journey, between an idea and its practical realization; the patent still exists as a stumbling-block to the progress of others. Very few would be found willing to undertake the pecuniary risk and difficulty of experiments if all the honour and much of the profit were to go into the hands of other people.

The progressive system of payments seems evidently to be the most just and rational. When examined before the Patent Committee in the House of Lords of 1851, Messrs. Rendel, Fairbairn, Prosser, May, Westhead, Mercer, Cole, Hodge, Spence, Fothergill, and Fairrie were all in favour of progressive payments. The only objection appears to have been brought by one gentleman, who, in answer to the question as to whether any injurious effect was produced by periodical payments upon inventions, stated that, "Many inventions, though they have not been at all successful up to the third year, are still very ingenious and very good inventions, and consequently the payment might come upon the inventor, and very likely would, at the time when he had been expending money without reaping any profit; and the capitalists and others engaged in the concern would be very likely to throw the matter over altogether rather than pay the tax." It appears to us that the strength of this objection would vary with the amount of the banker's account of the "capitalist;" and it is thus a case coming under the head of the great question of cheap or dear patents.

There cannot be a doubt as to the value of the progressive system. An invention, while young, and the inventor while yet poor, ought both to be tenderly treated. At the same time, it is in the interest of the inventor himself that we would not advocate greatly cheapened patent protection. We would prefer that the money should be spent upon the making of complete models of mechanical inventions; of careful samples of chemical discoveries, &c. The outlay should also be returned to the country in the shape of a cheap and easily accessible publication of previous inventions.

As the country is so much benefited by the patent system, a system which, by supporting manufacturing industry, directly increases the wealth of individuals, and indirectly the wealth of the State, it seems utter folly to require a heavy sum from an inventor just entering upon a fresh and difficult enterprise. On the other hand, the public must be protected from "fishing" and obstructive patents. It has been proposed to levy an income tax on the profits of inventions. The difficulties in raising such a tax will be at once apparent. It appears to us that the Belgian system of progressive annual annuities is the most equitable to all the parties concerned—patentees, the public, and the State. A fine should be levied for unpunctuality in the payments; it is iniquitous to confiscate a patent on account of a short delay in a payment. If all kinds of property were thus liable to confiscation, estates would change hands rather oftener than at present. An annual progressive increase completely takes into account the success or non-success of the patent; and an invention, while in the bud and undeveloped, would receive more tender handling than under the present system, by which an inventor often has, on an average, to pay £100 by the time his patent has lasted only three years. While advocating the general principle of progressive payments, we would suggest with regard to the present fees in England, the abolition of the Government stamp duty of £50 at the end of the three years; and the conversion of the £100 stamp into one of £80, at the expiration of the seven years.

THE SPITHEAD FORTS.

THE Spithead forts, which we did our best to oppose last session, and with some success, are again proposed to be erected. The repulse of the Federal iron-clads by the Charleston batteries has revived this question, and aroused in the Government officials the hope of carrying out the great Portsmouth contract job, involving an expenditure of more than a million, which for a time eluded their grasp. The usual machinery to play on the public mind, is set to work; and we are assured, as if it were a gratifying announcement, that estimates for resuming the construction of those useless harbour defences will shortly be laid before Parliament.

Last year we succeeded in showing the doubtful utility of these works. We hope to be again equally successful. Since then the circumstances affecting the case have undergone no change. The destruction of one badly constructed and inefficiently armour-plated gunboat, and the disabling of two little "Monitors" carrying two guns each, are events which, properly considered, have not the slightest bearing on the question. The disastrous result of the Federal attack on the Charleston forts only proves the miserable inefficiency of the iron-clads with which the attempt was made.

The real point for consideration is, which is the best kind of defence for a broad sea channel leading into a harbour, fixed or floating batteries? Here is a million of money or more to be spent for the protection of an important arsenal. Shall we cast it into the sea to build forts on sandbanks, where they must remain immoveable, or shall we employ the same sum to build five or six floating batteries of transcendent power? No doubt exists that our naval engineers can produce moveable fortresses calculated to resist and carry the heaviest ordnance that can be constructed.

There is evidently a design to take Parliament by surprise, and carry a resolution for the construction of the Spithead forts by raising false issues. The members who understand the question and influence the House, can only save the country from a useless expenditure by constant vigilance, and especially by laying the facts plainly before the country.

In referring to moveable defences, we do not mean line-of-battle ships, frigates, or sea-going cruizers of any class. We mean literally floating fortresses. Of this class of structure, which is of more importance for the protection of our shores than the whole of our existing fleet, not one yet exists. To this grave fact we draw public attention. If we are to spend another million or two for harbour defences, let it be applied in the most efficient way.

The guns of a fort, at the entrance of a channel a mile wide, can only reach invading ships at long range, which immensely diminishes the efficacy of their fire. The number of shots from the Confederate forts which struck the Federal iron-clads was 50 to 60 on each vessel, and yet they did comparatively little damage. If floating batteries carrying 300-pounders, such as smashed through-and-through the Chalmers' target the other day, had defended Charleston harbour, there is little doubt every one of the "Monitors" and the "Ironsides" frigate, with their weak system of armour, would have been sunk. Or if the Federal squadron had been composed of a more efficient class of iron-clads, they would have run the gauntlet, passed by Forts Sumter and Moultrie, and laid Charleston in ashes.

Much stress is laid on the obstructions placed in the channel to stop the enemy's vessels. But the use of floating instead of fixed batteries does not prevent similar obstructions being laid down. On the contrary, it would render the value of such obstructions much greater. Imagine the Federal ships brought up in the channel by rows of stakes, chains, and booms, with a fleet of Confederate floating batteries inside, pouring in broadsides of 300-pounder steel shot at 200 or 300 yards, would not the chances be infinitely greater against the attacking force, than under any fire at 1,200 yards? This is the true way of looking at the question of the Spithead forts. It was shown, during the last discussions, that the range of any effective fire from them could never be less than 1,000 yards, as the enemy would keep in mid-channel, which exceeds that distance from the proposed site of the forts.

Lord Hardwick went out of his way to cite instances of the failure of fleets in attacking land batteries; but these are accounts of the defunct school of naval warfare, when wooden vessels knocked their heads against stone walls. *Nous avons changé tout ca.* Iron walls afloat would go alongside any of the fortifications the noble earl alluded to, knock in the embrasures, and drive the artillerymen from the guns, as the "Merrimac," with only four guns, did in Hampton Roads. It is really idle to bring up old world stories about wooden ships in this iron age. It would be just as reasonable to refer to the battles of Actium or Lepanto as events for estimating the offensive power of iron-clads.

We cannot dismiss this subject without reverting to the five new iron-clads for which a million and a half was voted. The question arose whether they were to be built of iron or wood. There was a unanimous feeling in the House that they ought to be iron ships, and a determination not to allow any more iron-clads to be built of wood was plainly evinced. To conjure the rising storm, the Premier gave a pledge that if the point were left to the discretion of the Admiralty, the money would be employed in the way most beneficial to the country. He, moreover, stated that before any part of it was expended, experiments would be made with the "Valiant" and "Royal Oak"—the former an iron, the latter a wooden armour-plated ship—in order to determine which class of men-of-war was most suitable to the service. It was understood that these experiments should extend, not only to the sea-going properties of the new vessels by testing them on a cruise in search of gales, but to the trial of a wooden ship target at Shoeburyness. Neither of these promises has been fulfilled. One is already broken; for a few days ago it was announced that the "Belvidera," a wooden ship, was laid down to be converted as one of the five new iron-clads. This Palmerstonian method of first evading a hostile vote and then deceiving the country, is deplorable. When will the House of Commons have the public spirit to put an end to it?

The experiments on targets with explosive shells render the "iron *versus* wood" question one of vital importance. The results proved that Whitworth and Armstrong shells will penetrate the "Warrior" class of armour, and with their incendiary charge will set a wooden ship in flames. Is Government to be allowed to spend more money on vessels costing a quarter of a million each, which cannot fail to be destroyed the first time they go into action?

If the country is satisfied that Portsmouth Arsenal ought to be protected against the possible attack of a fleet of iron-clads, it will be ready to grant the sum required for that purpose. Parliament will raise no difficulty. The Government proposition, which probably will be a loan on terminable annuities, will be readily acceded to. But it will be the business of the members, who understand the question, to demand that the money be applied to the right class of defences, and to the construction of those works which are the most useful and urgent. The reasons we have stated leave no doubt that floating batteries are far more useful and urgent than fixed forts on sandbanks. The Chancellor of the Exchequer will be disinclined to increase his Budget. There is little doubt the money intended to be asked for, will be, as we have suggested, in the form of a loan. No possible reason can be adduced why the sum required for the construction of floating batteries should not be raised in that way as well as for the construction of forts. Already we perceive an attempt is being made to impress the public with the idea, that a large sum having been spent on the Horse, Noman, and Surbridge marine forts, it would be deplorable that that outlay should be lost to the nation. Never was there a worse argument. The very reason which induced Parliament to suspend the works—viz., the conviction of their inutility—is the best reason for abandoning them altogether. We have a proverb which exactly applies to this case—"What is the use of throwing good money after bad?"

HIGH-SPEED STEAM ENGINES.

SMEATON, Morin, Poncelet, and many others have given us accurate rules for the construction and speeds of water-wheels; rules which must be observed, if we wish to obtain the highest practical results, the nearest approach to theoretical perfection. Such rules are invaluable, because the mechanical effect of water depends solely on gravity-pressure, which is the result of gravity, or on a combination of both; hence, a certain velocity, to a great degree fixed and determinate, will invariably give the best results with any particular description of water-wheel; for, it is sufficiently evident, that if its circumference travel at the same speed as that due theoretically to the water under the action of gravity, no useful effect can be developed; and, on the other hand, if the entire weight of the water be claimed, no motion, and, consequently again, no useful effect, can be realized. These laws are, or should be, so well understood, that we feel inclined to apologize for their introduction here; still an allusion to them may help to simplify matters further on.

Smeaton, however, and other writers on the same subject—knowing doubtless how difficult it is to make invariable laws, no matter how correct, suit varying circumstances—permits a certain degree of latitude in the observance of his rules, and, steering between what is theoretically right and practically wrong, tells us that the best speed for the periphery of a water-wheel lies between 6 ft. and 3 ft. per second—a difference considerable in amount, yet rendered necessary by the varying diameters of different wheels. The reasons for such rules are sufficiently evident; simple inspection enables us to appreciate them.

But when we come to treat of steam—a subtle fluid, acting wholly by pressure, and flowing through passages, and from vessel to vessel, with a speed which is practically instantaneous—the question whether fixed constructive rules are valuable, or even necessary, when applied to machines for which it furnishes the motive power, assumes a widely different aspect; and we do not hesitate to assert that a blind adherence to such necessarily empirical formulæ is not only a bar to progress, but simply absurd on the part of the constructive engineer. It rather causes him to gaze at his subject from only one point of view, and adopt but one mode of construction for all sorts of circumstances; hence, many engineers look on high piston speed as a heresy, because it is opposed to the rules laid down by Watt and others when steam was yet in its infancy; they thus continue to apply rules written long ago to engines of a construction never contemplated by their framers—rules, the reasons for which indeed are sufficiently doubtful, even when applied to the cases contemplated, but when adopted in all their integrity, amidst the exigency of modern practice, are productive of the most injurious results. Smeaton's rules differ in resting on a good foundation, and being applicable to every description of water-wheel; we cannot say as much for Watts'—applied to the steam-engine. One of them—that regulating the speed of pistons in condensing engines, and applied in all its force to non-condensing engines by others—we regard as especially unsuited to modern practice.

This rule fixes the speed of pistons at 240 ft. per minute as that theoretically best for all engines of the larger class. Most works on the steam-engine, too, contain rules given with the most painful minuteness for ascertaining the correct speed for a certain length of stroke; in most if not all cases, such rules, if not founded on error, can at least be departed from to almost any extent with the best results; modern experience daily proves the correctness of our assertion.

Granted that we have steam enough and pressure enough in our boiler, we can have but two circumstances to dictate the speed at which any engine can be driven—the resistance produced by momentum in the reciprocating parts, which may be so excessive as to knock the engine to pieces; or the size of the pipes, ports, or passage, through which the steam is led to or from the cylinder. We have seen that any increase in the speed of a water-wheel above a certain point must result in loss of useful effect, because, so to speak, the water cannot follow fast enough; but nothing of this kind can occur with steam until the speed becomes so excessive as to be immeasurably beyond all practical requirements. No one will be rash enough to assert that the pressure on the piston can be less than that on the lid of a cylinder, until a speed almost infinite is attained.

We have no evidence to show that any other considerations than those due to the best theoretical speed for the pumps, and a due allowance of time for condensation, ever influenced Watt in drawing up rules which have met with a world-wide acceptation. 120 ft. per minute is a high speed for large pumps; in fact, just about the highest at which they will be found to work quietly and satisfactorily without a resort to extraordinary expedients, such as permitting a pause at the end of the stroke, as in deep mine pumps, quite inapplicable of course to rotary engines of which we are speaking; and as Watt's air-pumps generally worked at "half-beam," this is just the speed of their pistons. But it is quite evident that many plans might be, and indeed are daily, resorted to, by which the speed of the steam piston is rendered quite independent of that of the pumps; nevertheless, any departure from the old established speeds is strongly condemned by a numerous class of engineers.

Now we do not for a moment mean to assert that, *cœteris paribus*, 240 ft. per minute is not just as good a speed as any other, faster or slower, which we may choose to adopt. We do not believe that there is any fixed rule for piston speed; but we do believe that a blind adherence to a low speed of piston, causes the general adoption of cumbrous, heavy machinery, weighing and costing much more than it ought, and in many instances inducing an extra expense in the necessity for machinery, otherwise needless, to get up the speed of the mill or other works driven by the engine, and in addition rendering it necessary to employ a piston, whose size, in order to obtain power enough, is an effectual bar to any extended use of expansion, owing to the shock of high steam on such a large surface.

Most writers on expansion mention different expedients to overcome the varying speed of the engines; strange, that, almost without exception, they totally disregard in all their calculations the question of piston speed or the number of strokes per minute. Now, machinery running at a high speed cannot have its velocity changed instantaneously. A certain amount of time is necessary to produce retardation or acceleration in any appreciable degree; the same is true even of a heavy fly-wheel. It is quite possible to drive a piston at such a speed with a short stroke, that, though expanding its steam ten or twelve times, the engine will make its strokes so quickly that the momentary variation in force through different parts of the stroke will not have time to influence the machinery driven, to any appreciable extent; the speed once attained, will be equable; and at the same time, the size of the piston will be so much reduced, that no injurious effect can be possibly produced by the effect of high pressure steam on its surface. Indeed, no means of overcoming this evil of the first shock of the steam presents itself in as favourable a light as the use of a very small piston travelling at a high speed.

All parties admit that by a multiplication of cylinders we may attain any desirable amount of regularity of speed, no matter what the expansion, simply because the whole amount of irregularity or variation of force is shut up and divided amongst a number of strokes, instead of being all concentrated, so to speak, in one or two. But this subdivision can just as well be obtained by driving a single piston at such a speed, that the number of strokes performed by it in a minute may equal the aggregate number of strokes performed by a number of pistons giving out the same horse-power. Thus, if we suppose an engine working at twenty revolutions per minute, and say, for the sake of simplicity, that the speed shall vary twice in each half-revolution, it is evident that there will be eighty variations in force per minute, and each variation, occupying something like three-quarters of a second, may very easily overcome the inertia of the machinery driven, and consequently cause a considerable variation in speed. If now we drive the engine at one hundred revolutions per minute, the changes in force will be, to all intents and purposes, instantaneous, and cannot possibly produce any material effect, except on very light machinery, when the introduction of a second cylinder will at once give us all we can desire.

But, further, it must be remembered that the pressure on a crank pin of a high-speeded engine is never identical with that on the piston—indeed, with a heavy connecting rod and piston, the strain on the crank pin frequently exceeds, at the latter end of the stroke, that due to the initial pressure of the steam at the commencement; thus, another element is introduced, so important that it is quite possible to construct an engine which could not give a perfectly equal speed without expanding very considerably. In fact, we have a practical proof that such is the case, in a pumping engine, the speed of whose piston is tolerably uniform throughout its stroke, although the steam is expanded six or eight times; we have seen a locomotive jacked up, working at about 120 revolutions per minute, and expanding its steam six times, when driving all the machinery of a repairing shop with a regularity of speed which we have seldom seen equalled.

As to loss of power by condensation in the cylinder, everything is in favour of a high piston speed. A given weight of steam can only produce a certain amount of useful effect, whether we make it give out that effect in an hour or a minute. In a slow-speeded engine, the cylinder, instead of being kept at an equable temperature, has ample time to grow warm on the entrance of the steam, and cool while it does its work. The transitions in temperature, like the variations in force, are too short-lived, in an engine rising many strokes per minute, to permit any such result; in consequence, a very considerable gain in this respect has always been found to attend the use of a high speed. It is not so much loss of heat by radiation from the outside of the cylinder that is to be dreaded, as loss of heat by radiation into the condenser or atmosphere from the inside, which is also lowered in temperature by the expansion of the steam within. When meeting such difficulties, a quick reciprocation, a moderate amount of superheating, and a cylinder carefully clothed all over, ends as well as sides, will always secure the best results.

Modern practice seems to turn to the path we point out. In the locomotive we see an utter disregard for those rules, which we have stigmatized as defective, attended with the best results. There we see a pair of small cylinders giving as much useful effect as colossal machinery, while the consumption of fuel is reduced to some three or four pounds of coal per horse-power per hour. We believe that in the increase of piston speed, and in the multiplication of *uncombined* (in the McNaught sense of the term) cylinders, the real road to successful practice will be found; as by these means alone can we avail ourselves of all the benefits of expansion without extravagant first cost. No belief should obtain that a high-speeded engine is subject to an injuriously greater amount of wear and tear than one rising at slower speed; it is merely a question of workmanship and design, and our readers may rest assured that to modern English engineers this part of the question presents no difficulty.

THE QUANTITATIVE PROGRESS OF THE IRON MANUFACTURE.

From the year 1840 to 1860 the production of crude iron in England rose from 1,400,000 tons to 4,150,000 tons. It is not improbable that this amount will be increased in the course of the present year to five millions of tons. Nine years ago (in 1854) the quantity of crude iron produced in England was more than 3½ millions of tons. The quantity of malleable iron came up to nearly 2 millions of tons; at the current prices, this was worth 25 millions sterling; 242,000 steam-horses' power, and 238,000 operatives were employed in the manufacture. There is thus more crude iron manufactured in Great Britain than in all the rest of the world put together. France and the United States come next, as regards quantity of production; Prussia and Austria then follow. The times are thus greatly changed from those when, as Homer sang,

> A mass of iron, ...
> Rude from the furnace, and but shaped by fire,

light enough, in fact, to be carried away by one man, could be offered as a prize to the heroes competing at the funeral games of Patroclus.

Charcoal was, at one time, the only fuel thought capable of making good iron, but its scarcity and high price set a narrow limit to the quantity of iron that can be produced by the employment of this combustible. In those countries where wood is still plentiful, such as North America, Sweden, and Styria, &c., charcoal continues to be used, and the very best iron is the resulting produce. In England charcoal is only employed for converting malleable iron into plates and bars for tinning, and for a few other purposes for which the very best iron is required.

What may be called the first great epoch in the manufacture of iron dates from the application of a "flux," or of a substance that will fuse in combination with the earthy matter of the ironstone; the separation enabling the disengaged metal to flow freely from the furnace. Limestone is the flux that is almost universally used. The late Mr. Truran, in his work on the iron manufacture, states that chalk is made use of in some of the blast furnaces in the neighbourhood of Newcastle-upon-Tyne, but he believed that it is the only locality where chalk is so employed. As is generally known, the limestone is almost always found in close proximity to the iron ore and coal. In South Wales and Monmouthshire the limestone lies only a short depth below the seams of coal and iron stone. The quantity of pure lime contained in the stone determines its value as a flux. The chalk used as a flux in the Newcastle furnaces is stated to contain more than 50 per cent. of lime. The expense of this flux is, of course, greater than that of the limestone generally found below the coal and iron beds, as it has to be fetched at great distances from the iron-making districts. The limestone flux is generally at once charged into the furnace after the blocks have been somewhat broken up. In some iron works, however, the lime is utilized in a caustic state by previously being calcined in kilns similar to those used for the calcination of ores. It is doubtful whether the Romans used a flux in their iron-making. It is to be inferred from the quantity of iron found in the "cinder" of the still extant old Roman workings, that a flux was not used by the conquerors of the world. The name of the man who first used a flux is unknown. Like many other valuable inventions, its date is unrecorded.

It is noticeable that the first application in England of cast iron seems to have been to ordnance. This appears by a patent granted to Ralph Page and Peter Baude in the 35th year of the reign of Henry VIII (1543). The guns were cast at Backsteed, in Sussex. The Bessemer process for the manufacture of steel and iron also bids fair to form an epoch of itself. Like Ralph Page, Mr. Bessemer appears to have had mainly in view the production of a tough metal for long range ordnance. Significant but melancholy coincidence; illustrating most forcibly that intellectual and moral progress do not advance in parallel lines. Just as Ralph Page's charcoal pig-iron superseded the bronze cannon of Cressy, so will the Bessemer steel supersede all other materials for making cannon; and the progress of three centuries has thus resulted in giving man improved means for destroying his fellow-men.

The second great epoch in iron manufacture may be said to date from the year 1621, when Lord Edward Dudley obtained his patent for "the misterie and arte of melting iron ewre, and of making the same into cast workes or barrs with sea coles or pit coles in furnaces with bellowes." An account is given by Dud Dudley of his father's patent in the former's work entitled, "Metallum Martis."[*] There were two projectors previous to Lord Dudley, but he seems to have been the first successful patentee connected with the manufacture of iron. In the Act passed in 1628 against Monopolies (21 James I., chap. 3), Lord Dudley's patent, amongst others, is expressly excepted from being repealed by this Act against Monopolies. These exceptions form the foundation of patents for invention.

Dudley was persecuted on account of his discovery, and his works were destroyed by mobs. His process lay dormant a century after his death. The invention was perhaps premature, and at any rate it only came into use about the year 1740. The Governments of those days looked upon the iron manufacture as the natural enemy of the oak forests that formed the wooden walls of Old England. By the year 1740 the home manufacture had sunk to less than 18,000 tons per annum, under the united pressures of a diminishing supply of charcoal and of legislative discouragement, while the troubles of the preceding century had so checked industrial undertakings that the imports of iron did average more than from 30,000 to 36,000 tons in the year 1740. By means, however, of improved blowing apparatus, Lord Dudley's invention was about this time turned to full account. In the interval between 1740 and 1788 the produce of iron was raised to nearly 70,000 tons per annum, and the imports increased to upwards of 50,000 tons. At about this period also, the impress of Watt's magic hand began to make itself felt on the iron manufactures, and the completed steam-engine came to be applied to raising the coal, the ore, and the flux from the mine, to blowing the furnaces, and turning the rolls, &c. Thus the steam-engine, while it increased the demand for iron, at the same time facilitated its production in large quantities, until at last, as within late years, more iron is employed in the production of iron than could be furnished by the whole country in the beginning of the present century.

It is only within the last few years that raw or uncoked coal has been used for smelting iron. As is well known, the volatile gases are expelled from the coal by the process of coking, and the carbon alone remains. Mr. Truran states that when this process has been carelessly conducted he has seen from one-fourth to one-half of the carbon thrown away. The loss is but small when coking is properly conducted. Only few descriptions of coal are, at present, considered fit to be employed in iron smelting without being first coked. The bituminous and semi-anthracite coals are generally coked before being charged into the furnace. The semi-bituminous and pure anthracite coals are used in the raw state. There are good reasons for the belief that all coals could be used raw, with a proper construction and management of the blast furnace.

The third marked epoch in the iron manufacture originated in the introduction of the hot blast. The great effect of the *hot*, as compared with the *cold* blast, in economizing fuel, has been generally ascribed to the absence of the cooling action of the cold blast on the combustion. This is the opinion maintained by Dr. Thomson in his report to the British Association, by Dr. Clark in a Paper read before the Edinburgh Society, and by the late Mr. Mushet in his Papers on Iron and Steel.

There are reasons that make this explanation rather doubtful. Mr. Truran ascribed the economical superiority of the hot blast to two separate causes:—"The first is, that the heat thrown into the furnace along with the blast, permits a corresponding quantity of coal to be withdrawn from the burden of materials, and a proportionate reduction in the volume of blast. The effect is seen in the augmentation of make, but not in any saving of fuel. The second cause is, that the reduced volume of blast, and the large amount of heat which it carries with it, cause a diminished consumption of fuel in the upper parts of the furnace, the result being that a quantity of fuel is saved at the furnace greater than what would be due merely to the caloric introduced by the blast." The precise action of the hot blast does not seem as yet to have been thoroughly investigated. It is well known that a blast furnace works better in winter than in summer, on account of the less quantity of aqueous vapour contained in the atmosphere in cold weather; it is not improbable that heating the air may have an *indirect* tendency, under certain circumstances, to deprive it of its moisture.

The credit of the invention of the hot blast is, as is well-known, due to Mr. J. B. Neilson, of Glasgow, who, in 1828, took out a patent for the plan. (Specification, No. 5701, Old Law.) The benefits of this discovery were greatly felt in Scotland; the coals of that country being generally unfit for coking; losing, in fact, 55 per cent. in the process. By using the hot blast, the coal could be sent in its raw state to the blast furnace, and a saving of one-third of the fuel was the result. The hot air seems to have a purifying influence on the coal, rendering less necessary the process of coking, and making inferior coals more available in the manufacture of iron.

We have thus an unlimited supply of fuel, of ore, and of flux, with no want of manufacturing capital and energy to second these resources of nature. The result is a manufacture transcending in extent everything else of the kind in any other time or country. But there is also an unlimited competition; and, unfortunately, quality is too often overlooked in the race after quantity. The immense impetus given to the make of malleable iron, by its demand for the war and mercantile navies of the world, has raised the demand for good qualities of iron. For iron ships of war, good iron is a question of life and death—of victory or defeat. Our iron-masters would do well to reflect on the possibility of the Government taking the manufacture of armour-plating it requires into its own hands, in case the quality of English iron continues to lag so far behind its quantity. They would also do well to remember the course that the Federal Government found itself obliged to take with regard to the production of iron for naval purposes. We may never know to what extent the late repulse of the Federal gunboats before Charleston was due to the bad quality of the iron armour plates. Last year, however, the American Government gave out, as a result of its own experience, its determination to be independent of the private dockyards and ironworks. The intention of that Government is to manufacture itself all the iron that is needed for the construction of our iron navy.

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[*] See Mr. Woodcroft's Abridgements of Specifications relating to the Manufacture of Iron and Steel, 1858.

Having thus briefly traced the quantitative progression of the iron manufacture, we will take occasion to offer a few observations on what may be termed the quantitative retrogression in the make of iron.

ENGINEERS AFLOAT.

THE following is a statement of the disabilities under which the Royal Naval Engineers consider they labour, and of the means they deem necessary to place them on a more satisfactory footing than they at present occupy in Her Majesty's Service:—

1st. That the pay of naval engineers is insufficient, and that an increase of pay in their case would be a measure not only of justice but of wise economy. Of justice, because with their present rates of pay they are unable to maintain the position their rank in the service demands, and also because the other officers of the civil branch, of equal rank, are better paid for services which the engineers consider are neither more responsible nor arduous than their own. And of a wise economy, because by increasing the pay the Admiralty would then be able to secure the best of the engineering talent of the country for the Royal Navy, and as the duties and responsibilities of the engineers are daily increasing in consequence of the various additions and alterations to the mechanical arrangements of ships generally, so also is the necessity for increased skill and intelligence on the part of the engineers.

2nd. That naval engineers be permitted to retire at an earlier age than at present allowed, with an addition to the rate of half-pay to which they may be entitled. The request for retirement is submitted on the consideration, that from the peculiar and trying nature of an engineer's duties, his constitution receives injury, and as a rule it will be found he is physically incapacitated at an earlier age than 60 years for the active discharge of the duties of a chief engineer at sea.

3rd. That the accommodation for assistant-engineers is, as a rule, positively bad; that it would be conducive to the good of the service if they were made gun-room officers; that the senior assistant in all ships should have a cabin, and that when an assistant engineer is in charge he mess in the ward-room. The accommodation generally is so bad that we believe it to be one great cause of disease, and were the assistant-engineers made gun-room officers, we believe it would tend not only to improve those already in the service, but be the means of inducing a superior class of candidates to offer themselves for entry, as well as saving space in the ship. The peculiar duties devolving upon the senior assistant make the want of a cabin more felt by him than by any of the others. Allowing the assistant engineer in charge of the machinery to mess in the ward-room would be beneficial to the service, by placing him in close communication with the other heads of departments in the ship, and materially strengthen his position in the execution of his duty.

4th. That assistant engineers, after serving the prescribed period, and having passed either a provisional or other examination, receive the pay of the next higher class; that after becoming commissioned officers they be allowed a scale of half-pay; and that all time served from date of entry count for full and half-pay; their names also to appear in the Navy List on becoming commissioned officers. Under the present system, the assistant engineer, after serving the stipulated period, and passing his examination for a higher class, is kept waiting for his promotion, generally for a long and indefinite period, which we think ought not to be the case.

5th. That the widows of engineers be granted ordinary pensions. They feel convinced that this measure is one of great moment to the junior branches of the class; the nature of an engineer's duties frequently impairing or destroying the health of the most robust before they attain the position of chief engineer.

6th. That a distinct rate of half-pay be granted to inspectors of machinery afloat, according to their rank, and that full and half-pay, both of inspectors of machinery and chief engineers, be allowed to increase at a proportionate rate for each year's full-pay service, as the present system of requiring five years' service to be completed, for an increase of full and half-pay, is productive of great hardship to those officers who, from illness or inability to procure employment, fall short (possibly by only a few months) of the required time, and thereby lose the advantage of their service, during the remainder of the interval.

7th. The engineers of the Royal Navy, viewing with satisfaction the course pursued from time to time by their lordships in appointing naval engineers to fill vacancies in the various dockyards, trust the practice will be continued, as they are convinced such a course has been, and will be, productive of much good, and benefit the public service.

NAVAL ARCHITECTURE.

THE following is a brief abstract of a Paper "On the Naval Architecture of the Exhibition of 1862," contributed by Admiral Paris, C.B.:—

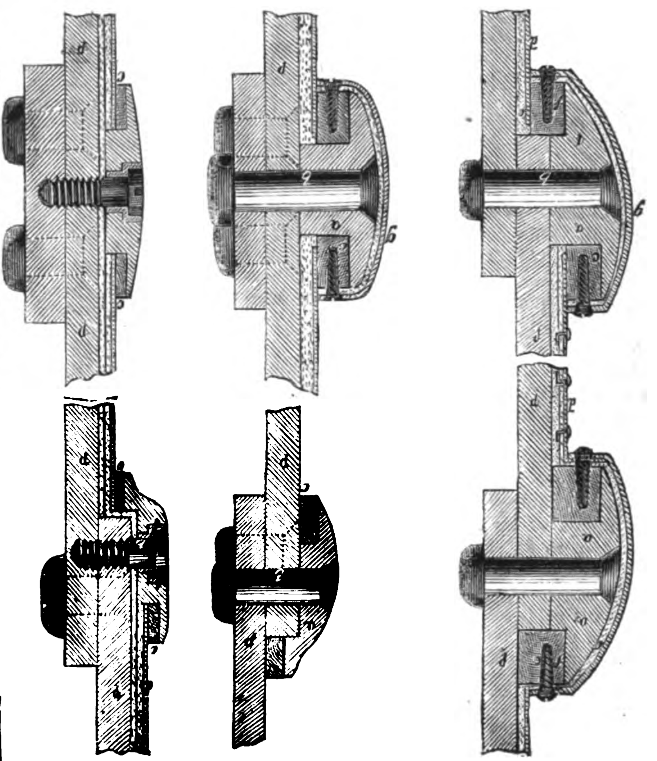
The author began by referring to those terrible guns which were in the main gallery of the Exhibition, and after speaking of the perfect mechanism displayed in their manufacture, went on to consider the purposes for which they were made, and thus came to the models of men-of-war, representing Naval Architecture as it was, as it is, and, for some little time at least, as it will be. Although, after leaving the artillery in all their reality, it seemed almost a disappointment to have to view our war ships on so small a scale, yet they represented the greatest revolution of the greatest art of man, and showed the long train of attempts and labours through which the actual maritime generation had passed; for sailors not yet old have had to contribute towards forming four quite complete and different navies during the last forty years. The most curious and complete collection the author stated was the one exhibited by the English Admiralty, who had conceived the happy idea of representing a succinct history of Naval Construction since the building of the "Great Harry," in 1488. The great difference between the style of architecture of that day and the present was spoken of, and science was charged with having deprived the art of its elegance, while she had given to it qualities which were better suited to it, and which had rendered our modern vessels more like real ships of war The model of the "Howe," three-decker, was referred to, and after speaking of many good qualities which ships of her class possessed, and of the regret with which every old sailor saw those noble vessels superseded, the author stated that that class of vessel served to represent the first of the four periods of history illustrated by the Admiralty models. Paddle-wheel steamers were next mentioned, and although their introduction did not lead to any material changes, from the fact that their paddle-boxes occupied the most valuable part of the vessel's battery, yet they served to represent the second period in the history illustrated by the Admiralty models. The screw-propeller showed the third and most important period, since it allowed us to unite in one vessel all the qualities of a sailing-ship and steamer, without diminishing its military power, and at the cost only of a part of of the provisions and water. There were many difficulties, however, to be overcome before the screw could be applied as was desired, but these were surmounted in the first instance by M. Dupuy de Lôme, who caused the "Napoleon" to carry her ninety guns at a speed of 12 knots; and unless there came some other unexpected discovery, M. Dupuy de Lôme seemed to have produced the type of vessel destined to command the sea, and, in time, to be substituted for every other. But the introduction of terrible explosive shells soon showed that wooden vessels unprotected were entirely unfit to cope with them, and the author referred to the battle of Sinope as an illustration of this, and stated that solid shot could not have destroyed the Turkish fleet in anything like the short time in which the shells effected its destruction. This, then, he said, brought to our consideration the iron-plated ships, and with them opened the fourth and last period of the history of Naval Architecture as was set forth in the Admiralty department of the Exhibition. The author again mentioned M. Dupuy de Lôme as being the first to embody all the requisite qualities for a really good sea-going iron-plated ship in the "Gloire," and regretted that her model was not exhibited at the Exhibition. He considered the loss of guns, which must be a condition in the application of heavy armour to ships, to be adequately met by the invulnerability obtained in the ship. After dwelling upon the qualities most desirable in vessels of this description, the author came to the question of cost, and showed that it was the result of our increased command over our vessels which had led to the enormous increase of expense; since with the engine and screw we could drive a vessel of almost unlimited dimensions, while in our old sailing ships any material increase was impracticable from the inability to work the sails efficiently. With regard to the question whether it was most desirable we should have high speed and partial protection, or more perfect protection at the cost of speed, the author stated that too little consideration for perfect protection had caused alterations in ships which, although they may cause them to be better vessels in a heavy sea, would, at the time of fighting, deprive them of very many advantages of greater value. Reference was also made to a model of a cupola ship, and the author considered that the American war had demonstrated its utility in smooth water rivers, but that great doubts remained as to whether such vessels could be made sea-worthy; here he referred to the fact, that most inventions appeared to be of a defensive character only, and spoke of the many forms designed for glancing shot, with low, inclined sides and other similar contrivances, as so many utter failures, without a nautical quality worthy of notice. He next treated of vessels being used as *Rams*, and upon this subject, stated that a distinguished French officer advocated the use of the "prow" in the first book ever published on the screw-propeller, in 1843. As to which may be considered the victor up to the present time—the gun or the iron plate—the author considered that, with every chance of error in the aim, and taking into account wasted or oblique shot, the protection may be looked upon as inferior. The probable behaviour of our heavy iron-plated ships at sea was then treated of, and the author pointed out the great necessity for a proper distribution and adjustment of the weights, which now became a matter for more than ordinary care, seeing that the vessel's sides are so burdened. After some observations upon the question of rolling, the author suggested that certain sections of a vessel should be taken and dealt with separately, with a view of ascertaining the influences of each; and asked if experiments could not be made, to ascertain the influence of the inertia of the weights, and expressed by diagrams. In conclusion, he stated that a wide horizon of useful information existed, although as yet it was very obscure, and he believed the Institution of Naval Architects to be one specially adapted to throw light upon it, and to hasten in every way the advancement of naval science.

PRESERVING WOOD WITH PYROLIGNEOUS ACID.

From reliable experiments that have been made in Europe and the East Indies with railway sleepers which had been treated with pyroligneous acid, it has been demonstrated (says an American paper) that they endure three times longer than the same kind of timber, not so prepared, when exposed to similar influences. Many improvements that have originated in America have been first applied in other countries. This has been the case with respect to the treatment of timber with pyroligneous acid. Its application for such purposes was proposed in New York forty years ago, but it has not yet come into general use there, while it is in very common use in England. In the New York *Daily Advertiser*, of Dec. 24, 1823, a description was given of experiments that had been made in treating timber with pyroligneous acid, and its benefits and modes of application were clearly described. No railroads were then in existence; consequently, its use was chiefly urged for ship timber exposed to rapid decay. The article on the subject said:—"When seasoned timber or planks are hewn into the intended shape,'put them under cover for a week or ten days to protect them from the rain. During this time let the acid be applied to the surface daily with a bursh. It will penetrate an inch or more into the wood and will be found an effectual preservative. The central part of the wood or heart of the oak being less liable to decomposition, it will require less of the acid. The frame of the ship or boat may be put together when all the external parts of the timber are completely saturated. Green timber cut in thick forests after being saturated with this acid will be nearly as good for ships, steam and canal boats, as the teak wood of the East Indies or the live oak of our sea-soasts."

The pyroligneous acid recommended for this purpose was the condensed smoke of wood. The best way to obtain it is by the distillation of wood in an iron retort and the condensation of its vapour in a refrigerator. The charcoal thus obtained in a retort is of excellent quality for smelting iron, and the crude pyroligneous acid may be applied without any further treatment to the timber. It was not only recommended for ships' timber to prevent dry-rot, but also for the timber of gun carriages, posts set in the ground, the sills of wooden buildings, &c. By smoking timber in the same manner that hams are smoked, similar results are obtained, for the preservative agent is the creosote in the fluid and the smoke. In coal tar there is a similar preservative agent called carbolic acid, which in many of its properties resembles creosote. It answers the same purposes as an antiseptic for timber, and is used for this object, but it is disagreeable to apply; wherever it can be obtained conveniently, however, no better substance can be applied to timber intended to be exposed to moisture and the weather, more especially when in contact with the ground.

GRIFFITHS' METHOD OF SHEATHING IRON SHIPS.



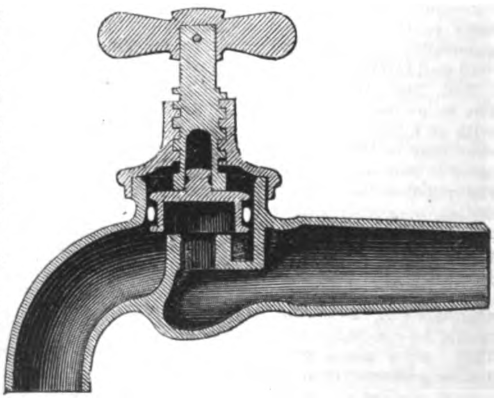
Section No. 1.

Mr. R. Griffiths, of Mornington-road, the well-known inventor of the "Griffiths' Propeller," has recently protected an invention for sheathing iron ships with copper to keep them from fouling. The engravings represent in section several methods of securing the sheathing. *a*, *a*, in the several sections shown, are strips or bars of iron or other metal secured by screws, bolts, or rivets *b*, *b*, along the longitudinal joints of the plates forming the shell of an iron ship. The application of the strips or bars *a*, *a*, to the longitudinal joints of iron ships has the effect of imparting great additional strength to the sides of such vessels, and also of protecting the heads of the rivets and joints which are covered thereby. The sectional form of the strips also affords the means by which the longitudinal joints of iron ships are effectually caulked and prevented from leaking, as shown by the upper part of section No. 1.

In place of the ordinary elastic caulking being employed for filling up the grooves formed by the strips, they may be filled with strips of metal, such as zinc, lead, or alloys of soft metal. The strips may either be fixed over the longitudinal joints when constructing iron ships by part of the bolts or rivets forming the joints passing through the bars *a*, *a*, and the plates *p*, *p*, of the ship, or they may be fixed over the longitudinal joints of vessels already constructed by rivets placed at an angle between the rivets forming such joints. Rabbets or recesses are formed between the inner surface of the bars *a*, *a*, and the iron plates *p*, *p*, of the vessel, into which strips of wood or other suitable caulking material *c*, *c*, is inserted for the purpose of making a secure joint, and also for the purpose, when required, of fixing and securing the edges of the metallic sheathing. A coating of marine glue, bitumen, Trinidad pitch, or other suitable adhesive non-conducting material *e*, *e*, is laid over the surface of that portion of the iron ship or vessel to be sheathed of sufficient thickness to thoroughly insulate the iron plates *p*, *p*, from contact with the sheathing metal *d*, *d*, when fixed thereon, the surface of the iron being first well cleaned and "payed" over with a solution of Trinidad pitch or other bituminous or adhesive material dissolved in naptha, petroleum, or other spirit. The surface of the vessel to be sheathed having been coated or covered, the inner surface of the sheets of sheathing metal *d*, *d*, are coated with prepared canvas, felt, or other fabric; and in order to secure it more firmly thereto, small nails may be driven through the sheathing and clinched at the back of the prepared canvas. The sheets of sheathing metal *d*, *d*, thus prepared, are then applied to the prepared surface of the vessel to be sheathed, heat or other means being employed to cause the two prepared surfaces to adhere firmly together. In some cases the horizontal edges of the sheathing metal simply pass into the grooves or recesses formed by the bars *a*, *a*, being held securely by the wood or other filling *c*, *c*; in other cases the edges of the sheathing metal are turned up at right angles and secured, as shown, to the wood by screws or nails, or by the screws *f*, *f*, which secure the caps *g*, *g*, of sheathing metal, which cover and protect the bars *a*, *a*, such caps or covers *g*, *g*, being readily removed at any time for examination or repair if required. The caps *g*, which cover the bars *a*, *a*, are made of stronger metal than the sheets of sheathing metal, as they serve as protectors to the sheathing from the injurious action of chain cables or other rubbing surfaces. The vertical joints of the sheathing metal are made secure by riveting strips of metal along the vertical edge of one of the sheets, and then inserting the edge of the adjoining sheet between the strip and the sheet of sheathing to which it is fixed.

KENNEDY'S IMPROVEMENT IN TAPS.

Mr. T. Kennedy, of Kilmarnock, N.B., has obtained a patent for the following invention in taps. The accompanying engraving illustrates a tap embodying the improvements. A cylindrical chamber is formed in a convenient position on the tap pipe or body, and within this chamber there is formed a valve seat, the opening or openings of which communicate with the inlet end of the tap, whilst the outlet end of the tap communicates with a convenient part of the chamber outside of the valve seat. The closing detail consists of a kind of piston or plunger formed with a recess, in which there is fitted a disc or piece of an elastic



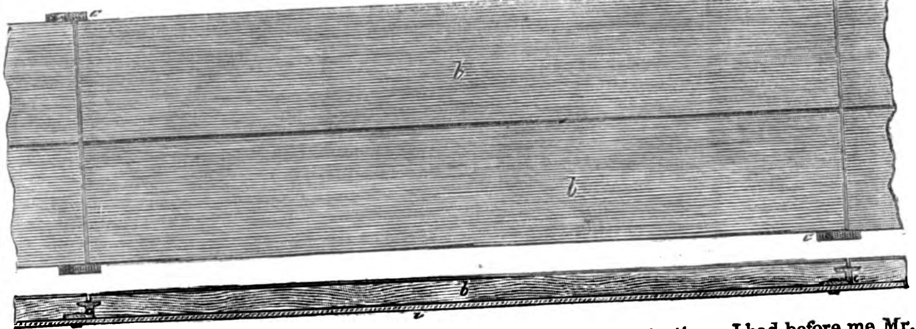
material, such as vulcanized rubber, and the closing detail is pressed against the valve by means of a screw spindle. The closing detail is connected loosely to the screw spindle, but so that the latter can draw it off the valve seat when the pressure is not sufficiently great to do so on the screw spindle being drawn out. The screw spindle works in a nut screw tapped in a cover, screwed or otherwise fixed to the top of the valve chamber. To prevent leakage through this cover a rolling packing is applied to the closing detail or piston, such rolling packing consisting of a ring of elastic material, such as vulcanized rubber. The packing ring is retained between flanges formed on the closing detail or piston, but these flanges are as much further apart than the thickness of the packing ring as will permit its necessary rolling movement. The inside of the chamber is turned smooth for the rolling packing to work upon, and if vulcanized rubber is used, the surfaces of the tap with which that material comes in contact are, by preference, tinned when such parts are formed of brass or other metal to which vulcanized rubber tends to adhere.

IMPROVED METAL SHEATHING FOR IRON SHIPS.

The following is a description of a plan for sheathing iron ships with wood and metal, recently proposed by Mr. W. Mulley, of Plymouth:—On the skin of the ship iron holdfasts *c*, are riveted. The holdfasts may be of any desired length, so as to secure two or more planks of wood *b*, as shown in the accompanying engravings.

The method to be adopted in carrying out the work is to begin by fastening one of the irons anywhere, say on the side amidships, between the lap-plates, then show the second iron its berth, and cut the sheathing off the exact length required, and quantity in breadth equal to the length of the iron; form the ends to correspond with the iron; when so fitted take them out again, and introduce bitumen, or whatever composition is to be used, and replace them; then bring the second iron to its berth, and fasten it, always with the flange outwards, and so on throughout. In parts such as the bows, quarters, and turn of bilge, the sheathing might vary both in length and breadth. The whole should be well caulked, thickly coated with pitch and tar, and be ready for felt and metal the same as an entire wood-bottom ship. Every part of the ship, including rudder, could be sheathed with equal facility—the metal braces brought outside of all, provision being made for the metal bolts passing through the iron sternpost, &c. The sheathing and iron holdfasts are of minimum dimensions.

MULLEY'S METAL SHEATHING FOR IRON SHIPS.



THE HYDROTESTOMETER.

At the last general meeting of the Institute of Naval Architects, Mr. Thomas M. Gladstone, C.E., Assoc.I.N.A., read a Paper "On the Hydrotestometer, or an Instrument to determine the Strain on a Ship's Cable when riding thereby, under all Conditions of Weather, and for other Purposes."

The author first observed that it had long been a matter for much observation to ascertain exactly what amount of strain a vessel puts upon her cable under various conditions and circumstances, and hence, he presumed, the subject would be one of interest to the Institution of Naval Architects. Hitherto, the proper strength and proportions of cables, &c., had been regulated by no really scientific data, and therefore if by suitable and convenient machinery such data could be accurately obtained, much good would be the result, since economy would be promoted, and greater security given to both life and property exposed to the dangers of the sea. From evidence given before a Select Committee of the House of Commons, in 1860, it was proved that the chain cables and anchors in the merchant service were in a most unsatisfactory and even untrustworthy condition, save in vessels of leading ship-owners, and those of large steamboat companies, and this it was that first drew the author's serious attention to the subject, and gave rise to those labours which have resulted in the "hydrotestometer." The plan of this instrument was submitted to Admiral Robinson, the Controller of the Navy, who received it so cordially that the author was induced to request of the Admiralty the co-operation of the Commodore and Master Shipwright of Woolwich Yard, and this request being granted, the whole merits of the instrument were fully discussed by those officers, and reported upon accordingly. After reading a report which he forwarded to the Admiralty, accompanying the one forwarded by the officers above referred to, the author stated that the want of scientific knowledge which the hydrotestometer is calculated to supply, delayed for twenty years the introduction of iron cables into the Royal Navy, so that the great economy effected by their use was also for that long period delayed. The "hydrotestometer" is on the principle of the hydraulic ram, and a drawing of one, which will measure a pressure of 200 tons, was shown. The instrument occupies but a small space, being 6 ft. long, 3 ft. broad, and 2 ft. high, and may be placed in any convenient position. It has a bridle attached to it, and a stopper to grasp the chain cable, so that the whole strain shall come directly upon the instrument; and the pressure or strain is at all times indicated by a pointer and dial attached for the purpose. He proposed that two of these instruments should be placed on board of two separate vessels of each class, the whole cost of which would be about £2,000, and he added that, when not in use for the special purpose for which they were designed, they might be employed in various useful ways, and from their capability of recording the smallest pressure, valuable results might be obtained. He desired that the instruments should be fully criticized, and a fair and impartial opinion passed upon it, since his desire was to render our knowledge of the strain exerted upon cables just as exact as it is upon the force of the wind and tide, and he believed that such information would give to the shipbuilder clearer views upon the qualities of his models, and tend to perfect the lines of every ship built in the future.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

At the annual meeting of this society, April 21, 1863—E. W. Binney, F.R.S., F.G.S., President, in the chair—Mr. Leopold Hartley Grindon was elected an ordinary member of the society.

The following reply to Dr. Rankine's Paper, read at the last meeting, was communicated by Mr. Dyer:—

In Dr. Rankine's Paper, entitled, "Note on Two Events in the History of Steam Navigation," he calls attention to my Paper, "On the Introduction of Steam Navigation," and expresses regret that "the author has noted, either very slightly, or not at all, an event of paramount importance:—The first adaptation of the double-acting cranked steam engine to drive a paddle-wheel." Now, I own to have taken no notice at all of this double-cranked motion, simply because I did *not* consider it of much importance in attaining success in *steam navigation*. I had before me Mr. Woodcroft's interesting treatise, and I fully appreciated his advocacy of the claims of Mr. Symington for having "fitted up the 'Charlotte Dundas,' as the first practical steamboat, in 1801." This *fact* is fairly stated in my Paper.

I aimed to place before the society the several inventions and discoveries relating to the use of *steam power* to supersede that of wind to navigate vessels, and to prove that the final *success* was due to *Watt's steam* engine. No great stress need be laid on the double cranked action, or on any of the other methods used for *transmitting* the power to the paddle wheels. The principles involved in overcoming the resisting forces by steam power in navigation, are entirely apart from those relating to the mechanical means of converting rectilinear into circular motion. It seems strange that such able engineers as Dr. Rankine and Mr. Woodcroft should have given this prominence to the said double-crank action. Whatever may have been the degree of success in the case of the "Charlotte Dundas" in 1801, and whatever may be said about the bar to further progress of Symington's inventions by the *Duke's death*, the fact remains clear that his schemes died out with the Duke, as no more was heard of them after the "Charlotte Dundas," and from some cause, she was discontinued; and it was, in fact, fifteen years after her advent before the "Margery" came out from the same waters to enter the Thames, in 1816. What shall be said of the "enlightened" of Glasgow, if "Symington's practical steamboat" was suffered to rot and be forgotten, leaving no successor, and the inventor himself to remain unrewarded and unnoticed for fifteen long years?

Through the limited space allowed for the abstract of my Paper, Dr. Rankine was misled respecting the other *event*, also cited by him from Mr. Woodcroft's book—namely, that I had "passed over the first introduction of steam navigation into Europe, by Henry Bell, in 1812;" for in my Paper due notice is taken of this well-known experiment of Mr. Bell. Although his trial boat proved a failure, on account of its being a very small one, and of his want of pecuniary means for continuing or extending the experiment, and the lack of any aid or encouragement afforded him by others, yet his trial boat served as the model for constructing the "Margery," three years after, which, as I have before said, was a success, and the first steamboat on English waters. I, therefore, think that due honour should be paid to the name of Henry Bell, for his spirit and enterprize, and a due stigma cast upon the capitalists who allowed him to sink under pecuniary pressure, from which he ought to have been relieved by them in so important an enterprize.

Mr. Rawlinson, C.E., has been sent into Lancashire and Cheshire by the Government to report as to the requirements and capabilities of the neighbourhood, in the way of works of public improvement.

The Commissioners of Sewers, at their weekly meeting in the Guildhall, on Tuesday, decided not to proceed in opposing the railway bridge innovation at Ludgate-hill, as they did not think it wise to spend the ratepayers' money in so doing.

REPORT OF THE ORDNANCE COMMITTEE ON RIFLING SMALL ARMS.

The report of the Ordnance Select Committee on the various systems of rifling small arms has just been printed. The systems which were taken into consideration were what is known as the Enfield principle, viz., three or five broad shallow grooves, either of uniform or progressive depths; the Lancaster oval bore, with increasing spiral—the above in two calibres; the Whitworth hexagonal bore, with quick twist; and Mr. Westley Richards' systems of breech-loading applied to an octagonal bore—the two last in the smaller calibre only. In proceeding to determine the respective merits of the large-bore rifles, the five-grooved Enfield was first placed in competition with the Enfield service rifle, which, in all other respects, it resembles. As the width of the grooves is the same in both cases, it follows that the surface of the lands is considerably reduced in the five-grooved rifle; and the results obtained show that this alteration gives a decided advantage in precision. It appears that the question of increasing the number of grooves, or rather of reducing the amount of frictional surface presented by the broad lands of the service Enfield by running a narrow groove down each of the lands, has for some time been entertained by Mr. Boucher, the object being to increase precision by a tighter-fitting bullet, without sacrificing facility in loading. Two Enfields, constructed on this plan, were tried with two kinds of ammunition, viz., a disc bullet, and a polygonal-sided bullet, with cavity at base. The shooting was wild, however, and Mr. Boucher withdrew the disc bullet, preparing, however, for further trial with polygonal bullets of somewhat less diameter, and a slower burning powder than that used in the service. As the nature of the proposed experiments would have involved a long and laborious investigation, the committee decided that the suggestion should form the subject of a future and separate inquiry.

The five-grooved Enfield was next placed in competition with another, differing from it only in having the spiral increased to one turn in 63 inches. This increase of pitch led to improved precision at all ranges, but more especially at the longer ranges. The quicker twist has, however, the disadvantage of increasing the tendency to foul. Two five-grooved Enfields, both with one turn in 48 in., but one having a barrel heavier by four ounces than the other, with a corresponding diminution of weight in the stock, were next tried, when a very slight superiority in precision was found on the part of the heavier barrel. The latter was, therefore, selected for comparison with the five-grooved arm with a spiral of one turn in 63 inches, the result being that, in fair weather, the slower pitch was found sufficient for all ranges up to 1,000 yards. In boisterous weather, and at the extreme range of 1,200 yards, the results were in favour of the quicker twist. The committee were, therefore, led to give the preference to this rifle above the other varieties of Enfield arms submitted for trial.

The large-bore rifles on the Lancaster principle were of a calibre adapted to the service 0·55 ammunition, having an elliptical bore, and a spiral of one turn in 36 in. at breech, increasing to one in 33 in. at muzzle. The results obtained by the trial of this arm, in comparison with the Enfields, show that the sharp pitch adopted by Mr. Lancaster has the advantage in precision at all ranges above 500 yards, and that at 300 yards the precision of both rifles is about equal. The committee next proceeded to test the Lancaster rifles for precision after they had to a certain extent been fouled and exposed to the weather for several days, when it was found that the precision of these arms is not deteriorated by continued firing, while that of the Enfield is. An objection has been frequently raised against the Lancaster system on the ground of its supposed liability to lose its elliptical form through the unequal friction exerted in forcing the bullet into its larger axis; but the committee are satisfied, from their own experience, that the alleged defect, if it exists at all, is so inconsiderable as to be of little or no importance. It has likewise been urged that freeing at the breech, as in the Lancaster rifle, is a disadvantage, as the bullet has to undergo a certain amount of distortion in its passage through the narrower part of the barrel. The committee think that this distortion must at least equally occur in any rifle where the depth of the grooves is progressive, as in the Enfield; and they consider that an advantage may be derived from both freeing at the breech in one system, and progressive growing in the other, in cases where the expansion of the bullet has not been completed at the first moment of discharge. Reference to the experiments at Woolwich and Hythe, in 1853-54, shows that the freed breech was then considered to have the advantage of diminishing the liability of the bullet to slip. The same may be said of Mr. Lancaster's increasing spiral; and the results of all the experiments with the large-bore rifles show that in the Lancaster there is now no greater tendency of the bullet to slip than is common to most systems of rifling. Having carefully considered the relative advantages of the Enfield and Lancaster systems applied to large calibres, and adapted to the same ammunition, the committee came to the conclusion that the Lancaster has the advantage, both as regards precision when foul, non-tendency to accumulate fouling, simplicity of management (a smooth barrel being more easy to clean than a grooved one), initial velocity, and trajectory. As regards penetration, rapidity of fire, and cost of manufacture, the two rifles are about equal.

The committee next proceeded to a trial of the small-bore rifles, all of which exceed the service Enfields in weight of barrel, which excess is got rid of partially, and in the Enfield Whitworth entirely, by reducing the weight of the stock. It was held essential, in determining the fitness of any arm for military service, that it should retain its precision with that lubricant which has been proved by experience to be the best adapted to all climates and condition, viz., pure bees' wax. With a view to meet this condition, Mr. Whitworth submitted an ammunition in which the grease pellet was covered with a thin coat of wax, a combination which, in the opinion of the committee, failed to fulfil the requirements which render pure wax necessary; and, with a view to test the fitness of the service lubricant for small-bore rifles, experiments were made with wax pellets. With these the shooting of both the Whitworth and Enfield rifles was found to deteriorate, while that of the Lancaster rifle improved to a degree which rendered its shooting not only superior, but equal to that of the Whitworth and Enfield when fired with the grease lubricant. The precision of Mr. Westley Richards' breech-loading rifle was not affected by the employment of wax on the bullet. From these results it would appear that the wax lubricant in this form suits the Lancaster rifle, but the committee are inclined to think that its success is due rather to the fact that it acts as a wad than as a lubricant; and in this opinion they are borne out by Mr. Lancaster himself, who advocates the employment of a felt or other wad as being conducive to the attainment of the highest precision with rifles on his principle. It does not follow, however, that wax would be found suitable in a small calibre if applied on the bullet, as in the present service cartridges, as the bullet would have to be reduced in diameter to render loading possible under such circumstances.

In the experiments made with this lubricant it was observed that the Enfield and Lancaster rifles had a tendency to lead, and the loading, more especially with the former, was occasionally performed with difficulty. As this was not the case with the Whitworth rifle, the committee thought that a severe trial for fouling with this lubricant would be well calculated to bring out the relative advantages or disadvantages of the different systems of rifling, and with this view they decided to fire 1,000 rounds lubricated with wax from each of the small bores. The Enfield commenced to load with difficulty at the seventh round, which increased as the firing proceeded, the bullet on most occasions having to be forced through the paper, and at the 93rd and 606th rounds respectively the bullet jammed in the barrel, and had to be driven home by blows from a mallet. In the Lancaster rifle the loading was comparatively easy, although on some occasions unusual force was required to drive the bullet down the barrel. In the Whitworth rifle the loading from first to last was so easy as to require no greater pressure than the weight of the ramrod.

From the data obtained by these experiments, the committee arrived at the conclusion that the present Enfield rifle, 0·577 bore, is not constructed on the best possible principle of rifling. With its present twist, it fails in precision at distances above 600 yards, and any attempt at improvement by increasing the spiral entails a tendency to foul, and thus mars its efficiency as a military weapon. Another defect in this system is the large frictional surface which the broad lands present to the descending bullet, rendering a comparatively large windage necessary to secure easy loading. In the elliptical and polygonal systems the frictional surface is considerably reduced. In the Whitworth hexagonal bore, the resistance to the bullet is practically less than the ellipse, for, as the bearing surfaces in the polygon are perfectly flat, the bearing on each is a minimum, and the bullet in its passage down the barrel is exposed to pressure over a less portion of its circumference than is the case in the ellipse, where the surfaces incline to coincidence. In the course of the experiments, the Enfield and Lancaster principles have been tested in both large and small calibres, but Mr. Whitworth's polygonal system has been confined to small-bores; not that it is inapplicable to large-bores, or incapable of giving proportionately good results, but that, as with the weight of bullet and charge now adopted in the service, superior results are obtained by the reduced bore, Mr. Whitworth has expressed his unwillingness to employ an inferior construction when better proportions are available.

The committee are of opinion that, as the present system of musketry instruction is calculated to produce a very high standard of shooting in the army, the introduction of a weapon of great precision at long ranges would materially increase the efficiency of the infantry, and place it in a better position to keep down the fire of rifled artillery. But although the reduced bore has shown a great superiority in precision over the large calibre, and in some respect exhibited a greater suitability for military use, yet the wear that takes place in the percussioning is so considerable that the rifle in a very short time is rendered unserviceable. As regards ammunition, the committee think that the Whitworth cartridge is inadmissible for general use, and that, if a cartridge were constructed on the same form as the present service cartridge to suit the reduced calibre, its increased length would render it liable to break in the pouch, and it would be inconvenient to load with. The committee have been informed that the cost of the Whitworth rifle, if made of Enfield metal, and manufactured in large numbers, with a barrel 4 oz. heavier than the present service barrel, common bayonet, and iron furniture, would be about 15s. more than that of the service Enfield; but, as the wear is so excessive, the actual cost of its adoption would be much greater. For these reasons, they do not feel warranted in recommending the introduction of a small-bore rifle for the entire army; but they think that a partial employment of arms of such superior precision would be attended with advantage, and is not inexpedient. At the same time they think it only just to Mr. Whitworth to acknowledge the relative superiority of his small-bore rifle over all others of similar calibre that have been under trial. With the exception of the greater wear, and the difficulty of obtaining ammunition suitable both for rifle and for the service, the committee are of opinion that the Whitworth rifle, taking all other points into consideration, is superior to all other arms as yet produced.

The breech-loading rifles of Mr. Westley Richards have shown advantages peculiar to this species of arm; but, setting aside the expediency or otherwise of adopting a breech-loading musket for infantay, the committee consider the cost of the rifle (nine guineas) so excessive, as to preclude its introduction. At the same time they think that, for cavalry, this system of breech-loading, adapted to carbines, offers such advantages as to compensate for any additional expense that may be incurred by their general introduction in that branch of the army. With regard to the relative merits of the Enfield and Lancaster systems when applied to large calibres, a strict but impartial comparison on all points establishes, in the opinion of the committee, the superiority of the latter. Should it be desired to retain the present Enfield calibre, therefore, the committee, in the absence of any data of their own as to the value of the polygonal system applied to this calibre, are of opinion that the adoption of the Lancaster system will be attended with considerable advantages to the service, more especially as it can be accomplished without necessitating any change in the present service ammunition, or increase of the present cost of supply.—*Birmingham Daily Post.*

AMERICAN IRON BRIDGES.*

The great number of timber bridges, in America might be accounted for from the fact, that the first cost of the truss, or superstructure, of a timber bridge of any given span, was generally less than one-half that of an iron bridge of the same strength. Iron had been occasionally employed since 1835, but only within the last ten or twelve years to any extent.

Cast-iron tubular arches, including one of 80 ft. span, were erected from the design of Major Delafield, about the time when similar arches were adopted, by the late M. Polonceau, in the construction of the Pont du Carrousel, over the Seine. Major Delafield's arched ribs were elliptical in section, the transverse vertical axis being about four times the length of the conjugate axis. In 1858, an aqueduct bridge was erected at Washington, by Captain Meigs, in which the two arched ribs were formed of water-pipes, through which the water flowed. The span of this bridge was 200 ft., the rise being 20 ft. The pipes were circular in section, 4 ft. in diameter inside, and 1½ in. thick. This bridge was 28 ft. wide over all, and the roadway was of timber, supported on wrought-iron spandrils. The bridge was tested with the arched ribs filled with water, and with a load of 125 lb. per sq. foot upon the roadway, making the total weight on each rib about 350 tons. The thrust of one half of this weight upon each abutment would be about 470 tons, corresponding to a strain of 2 tons per square inch of sectional area of iron in the pipes. This strain did not include the pressure of the water in the pipes, which were proved to 300 lb. per square inch. These examples were, so far as the author was aware, the only iron arches yet completed in the United States; and with the exception of a few pivot bridges, and one or two ornamental bridges in the Central Park at New York, they comprised nearly all the cast-iron bridges in that country.

There were a small number of plate, or boiler-iron bridges. The first was erected in 1847, in place of a timber bridge, by Mr. Millholland, on the Baltimore and Susquehanna (now the North Central) Railroad. This was 50 ft. span, and the two girders were each 6 ft. deep, the two sides of each being formed of plates ¼ in. thick. Between the sides at the top a timber 12 in. square was bolted as a compression member, and the top was further strengthened by two wrought-iron bars, 5 in. deep by ¾ in. thick, while four similar bars were riveted along the bottom of each girder. The sides were stiffened by stay-bolts, enclosed in cast-iron distance pieces, 12 in. apart from centre to centre. The centre of each girder was placed exactly under the rails, which were spiked to the timber forming the compression member. The breaking strain of the pair of girders was equal to 250 tons of distributed load, and the weight of the bridge was 14 tons. When completed, this bridge was coupled at each end to a railway waggon; and was slung by chains to a temporary timber truss. It was then taken nineteen miles by railway, run exactly over the place it was intended to occupy, the existing timber bridge was cut away, and the girder bridge lowered with the permanent way ready for traffic, the whole operation not having caused an interruption of more than two hours.

Having been long accustomed to trussed timber bridges, American engineers, in adopting iron, naturally employed it in trusses also. But, before describing the various forms of iron truss bridges, the strength of American iron was referred to. It appeared, from a vast number of experiments made by the United States Ordnance Board, that there was but little iron in any American cast guns of a less tensile strength than 11 tons per square inch; and in 1851, the author had himself seen portions cut from 11-inch guns, weighing 6 tons 15 cwt., tested up to 16·14 tons. The transverse breaking strength of a large number of samples of re-melted iron, when reduced to the English standard of a bar 2 in. deep and 1 inch wide, resting on supports 3 ft. apart, varied from 27¾ cwt. to 48·1 cwt., the general strength being 34 cwt. The minimum crushing strength of the irons experimented upon was 37¾ tons and the maximum 77¾ tons. Experiments made by the Franklin Institute twenty-five years ago showed the mean tensile strength of cast iron at the first melting to be 9¼ tons; and the iron now employed by engineers in Philadelphia bore from 7·14 tons to 10·2 tons. In 1858, Mr. Albert Fink tested the iron used in the construction of a large bridge on the Louisville and Nashville Railroad. When the results were reduced to bars 2 in. deep by 1 inch wide, on supports 3 ft. apart, the minimum breaking weight was 29½ cwt., mean 32·68 cwt., maximum 39 cwt. This iron was a mixture of two-fifths cold blast, two-fifths hot blast, and one-fifth scrap. With regard to wrought iron, the experiments made by the United States Board of Ordnance gave a tensile strength varying from 17 tons to 33·3 tons per square inch; and those of the Franklin Institute a mean strength of 26 tons for plate iron. At the present time 27 tons was generally expected of American boiler plate. Other experiments were also quoted to the same effect; and it was remarked that, from what had been stated, American engineers might work up to rather higher strains than were commonly allowed in this country. The high qualities of the best American iron were due to the purity of the ore and of the fuel employed in the manufacture. In bridges of less than 150 ft. span, even when loaded with a weight of 1·34 ton per lineal foot of single line, the strains did not exceed 3·57 tons per square inch on wrought iron in tension, and 4·46 tons per square inch on cast iron in compression.

Of the iron truss bridges that were described, all had certain peculiarities in common, distinguishing them from the trussed structures adopted in this country. In almost every case the compression members of American iron trussed bridges were of cast-iron cylindrical or octagonal pipes. These simply abutted, end to end, against each other; and although means were employed to prevent lateral motion of the ends, flanges and bolts were never introduced for that purpose. Another, and one of the most important peculiarities was the depth of truss—a depth exceeding that employed by English engineers, except in rare instances, as at Chepstow and at Londonderry. American engineers considered a depth of one-eighth for spans of 200 ft. as only moderate; for shorter spans depths of one-seventh and one-sixth were common; and in the case of one bridge of 120 ft. clear span, the depth was 23 ft., or nearly one-fifth of the span. It should, however, be observed that, in some of the American trusses, the arrangement of the tension members was such that, if the depth of the truss were not considerable, the diagonals would be inclined at hardly more than 8 deg. or 10 deg. from the horizontal; in which case a very large quantity of material would be employed, in proportion to the supporting power obtained. No American iron or timber bridges were ballasted; nor had they any floor, only a foot-path of planks. In bridges having the rails at or above the level of the top chords, known in the States as "deck bridges," parapets were seldom employed; and the trusses were often so short a distance apart, that a passenger, on looking out of a carriage window, was unable to discover any support beneath the train. In no bridges of two or more spans were the trusses made continuous over a pier; each span being always treated as a bridge by itself.

One of the earliest iron trusses adopted in the States was a trellis, known as Rider's Bridge. Cast-iron T or angle irons were employed in compression, and wrought-iron bars in tension. These bridges were so slightly proportioned that they occasionally broke down, and the author was not aware that the plan was now adopted in new structures.

A detailed description was then given of the Murphy-Whipple bridge, having a span of 125 ft., with the railway supported on the lower chords. It was for a double line, and there were three trusses, 14 ft. apart, from centre to centre, the strength of the middle one being about one-half greater than that of either of the others. The trusses were 23 ft. deep, or 0·184 of the span. The top chord was formed of cylindrical cast-iron pipes, and the bottom chord of a chain of square bars, 10 ft. 5 in. in length between the centres of the eyes. Upright cast-iron posts, placed at the same distances apart, divided the truss into panels; and as the posts were in two lengths, they were each trussed by four round rods, to prevent lateral failure. The diagonals were in pairs of square rods, and were formed also as eye-bars, grasping pins 2½ in. diameter in the top chord, where the pipes abutted upon each other, and pins 3½ in. diameter in the bottom chord, thus connecting the links, or bars, of which it was composed. The diagonal tension bars only crossed each other in two panels on each side of the centre of the truss. The top and bottom chords were braced horizontally, with transverse and diagonal bars. The railway bars were supported upon longitudinal timbers, which rested upon transverse wrought-iron rolled beams. The total weight of the superstructure complete was 102½ tons, or 8 cwt. per foot of single line. With an additional distributed load of 3,000 lb. per lineal foot on each line, the tensile strain at the middle tension rods would be 4·27 tons per square inch in the outer trusses; but, with a train on a single line only, the ordinary working strains did not exceed 2½ tons per square inch in tension, nor 3 tons in compression.

In 1861, an iron bridge was erected on the line of the Pennsylvania Central Railroad, across the Schuylkill, at Philadelphia. It had two clear spans of 192 ft. each, and one pivot span, or turning bridge, 192 ft. long. The construction was similar to that just described, but the truss was only 19 ft. deep. The upright posts, or struts, were of wrought iron, so rolled that when two bars were put together they formed an octagonal tube. The top and bottom chords of the turning bridge were of wrought-iron rolled beams, so that either might resist extension or compression. The three spans for a single line contained an average of 5 cwt. of wrought iron, and 7½ cwt. of cast iron per lineal foot. The nett cost of the bridge, exclusive of masonry, was £8,144 10s. or £14 4s. per lineal foot; the wrought iron costing £22 15s. 6d., and the cast iron £6 11s. 3d. per ton.

The pivot was of a kind extensively employed for turn-tables. It consisted of a fixed and of a moveable cast-iron disc, both grooved to receive a number of steel rollers, each turned to the frustra of a double cone. A circular railway was laid around the pivot, but the wheels only bore upon it when the bridge was not truly balanced on the rollers. With a load of 14 tons balanced upon one of these bearings, the whole was revolved by a weight of 3½ lbs. hung over a pulley, and connected by a chord to the periphery of the turn-table.

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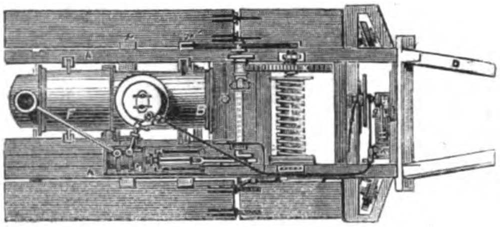
* Read before the Institution of Civil Engineers by Mr. Zerah Colburn, on May 5, Mr. Hawkshaw, the president, in the chair.

WRIGHT'S ROTATIVE TRAVELLING CRANE.

FIG. 2



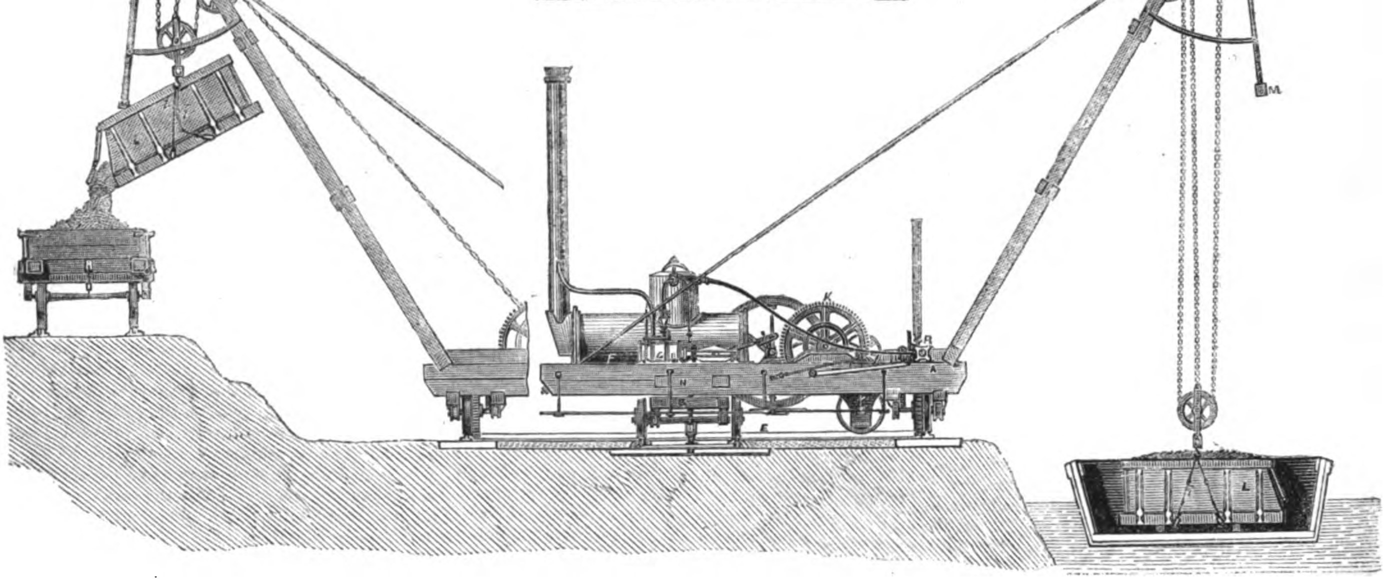


FIG. 1.

The form of truss introduced by Mr. Wendel Bollman was next noticed. In it the load upon each panel was transferred directly to the ends of the truss, through a pair of straight suspension bars, doing duty only in that panel. With the exception of one pair of suspension bars, supporting the centre of the bridge, the bars in each pair were of unequal length, and their lower ends were attached to the upper extremity of a compensating link, in order to allow for contraction and expansion. This bridge could not alter its form under unequal loading. A bridge upon this plan at Harper's Ferry, on the Baltimore and Ohio Railroad, had four parallel trusses for a double line, and a clear span of 124 ft. The span was divided into eight panels, and the depth of the truss was 17 ft. 6 in. The top chords were each formed of a single line of octagonal cast-iron pipes, and the vertical posts were also of cast iron. The strains upon the various parts of the truss, caused by the weight of the bridge and of a load of 1½ ton per lineal foot, were 2·8 tons per square inch in compression in the top chord, and varied from 4·46 tons per square inch in tension in the longer suspension bars to 7·14 tons in the shorter bars. Mr. Bollman had stated, that this bridge was tested with a moving weight of 122 tons of locomotives on one span of single line, or nearly 1 ton per lineal foot, and that the deflection at a speed of 8 miles an hour was 1⅜ in. at the centre.

The iron bridge designed by Mr. Albert Fink had been more extensively adopted than any other on the railways of the United States. In this bridge a pair of diagonal tension bars connected the foot of the principal strut or king-post in each truss, with the ends of the top chord. This pair of diagonal bars supported one-half of the whole weight of the truss and its load. Each half-span was subdivided by a strut, and two diagonal tension bars extended, one to the nearest end of the top chord, and the other to the top of the centre post. Each quarter span was again subdivided into eighths, and these again, for spans greater than 100 feet, into sixteenths. Under the direction of Mr. B. H. Latrobe, then engineer of the Baltimore and Ohio Railroad, in 1852, Mr. Fink erected an iron bridge of three spans, each of 205 ft., where that line crossed the Monongahela river. The depth of the truss was about one-ninth of the span, and the railway was carried at a little above the level of the bottom of the truss. The weight of the bridge, including the permanent way, was only ½ a ton per foot of single line, and, with an additional load of 1 ton per lineal foot, the tensile strains upon the wrought iron did not exceed 5·15 tons per square inch, and the compression on the cast iron 4·25 tons. The Green River and the Barren River bridges were then alluded to, as being nearly identical in construction to that last described.

The Bollman and the Fink trusses for a single line, and in spans of from 160 ft. to 200 ft., cost £14 per lineal foot, or nearly £28 per ton; while timber bridges of the same span only cost from £5 to £7 per foot. Still, iron bridges now met with an amount of favour which appeared certain to insure their ultimate substitution for timber bridges. A gradual preference was being shown to the plate girder, as the great annual range of temperature, from 20 deg. below zero to a reflected heat of 130 deg. in the summer sun, was not favourable to the use of cast iron in structures of such importance as railway bridges.

It was announced that the discussion upon Mr. Colburn's Paper "On American Iron Bridges" would be taken at the next meeting, Tuesday, May 12th, when the following Paper would be read:—"On the Communication between London and Dublin," by Mr. Watson, M.A., Assoc. Inst. C.E.

It was announced from the chair that the President's Annual Conversazione would be held on Tuesday evening, June 2, when the co-operation of members and visitors was requested, in order that a collection of models of engineering construction, and of specimens of works of art, worthy of the Institution, might be made.

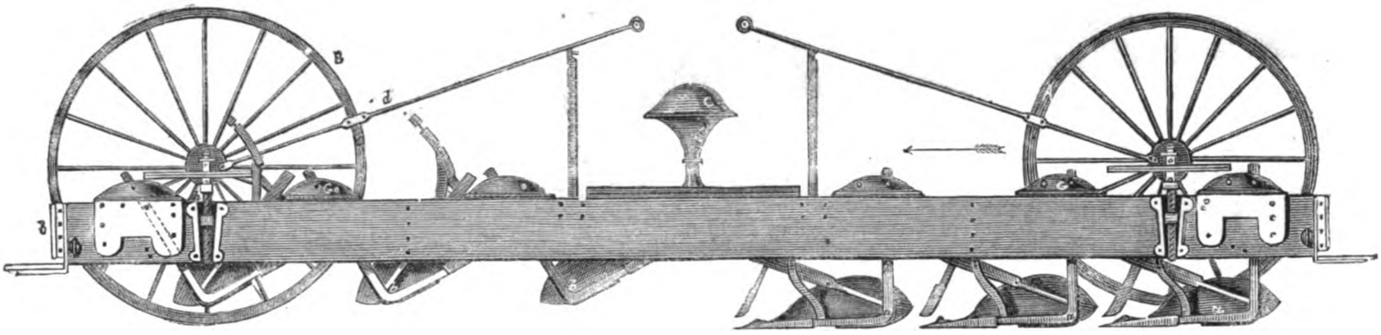
WRIGHT'S ROTATIVE TRAVELLING CRANE.

MR. J. WRIGHT, of Throgmorton-street, has recently patented an improved rotative travelling crane, which is constructed as illustrated in the above engravings.

On a stand or framing of suitable weight and strength an engine and boiler is placed, which, through a pinion on the main shaft, gives motion to a large cog wheel fastened on the spindle of the drum on which is coiled the chain passing from it to the extremity of the jib, and terminating in a hook or its equivalent in the usual manner. A tie-rod passes from the extremity of the jib to the extreme rear of the machine, by which means the weight of the boiler engine and the machinery counterbalances the weight of the substances or materials to be lifted. The whole apparatus turns on a circular rail round a pivot supported on a frame. The operation is as follows:—The chain is made fast to the substance or weight to be lifted, the engine being put in motion coils the chain round the barrel or drum, thereby hoisting the weight. When it has been raised high enough the crane is turned round on the circular rail before mentioned by means of a steam cylinder mounted on the framing, and connected by means of toothed gearing with the axles of the wheels. When not in use the crane can be transported from place to place by means of wheels, which can be raised or lowered by the action of a screw, and when not in use they may be drawn up out of the way of the circular rail.

Fig. 1 of the engravings is a side elevation, and fig. 2 a plan of the machine. On a strong and suitable frame A, composed of heavy pieces of timber, is mounted an arm or jib D, which is made as long and at as great an inclination with the frame as possible. The frame A is carried and supported by a carriage B, which moves along a rail by means of the wheels, and also by means of the wheel *i*, which moves on the circular rail E. On the frame A is also mounted a boiler F, and a steam engine G, which, through the crank C, gives motion to a pinion, which turns the large wheel K fixed on an axle carrying

PONCINS' STEAM CULTIVATOR.



the drum or roller I, on which is wound the lifting chain; the chain passes round a series of pulleys in the usual manner, and is connected with a trough or receiver L, by means of the links *i*, *i*, and a hook. The arm or jib D is composed of two pieces of wood, forming an acute angle whose lower extremities are united by means of the cross bar which rests on the frame A, and the pieces are also strengthened by cross pieces. The whole machine is centered on a bolt or pivot N, a cross piece passes under the rails of the carriage B, by means of which a greater counterpoise to the weight to be lifted is obtained. A donkey engine R on the frame A gives motion to a pinion, which is connected by means of gearing with a wheel bearing on the surface of the rail, which turns the whole machine round the centre N. Two other wheels, one on each side, serve to steady the machine. The action is as follows:—Supposing that the machine is employed to lift a shell or trough filled wih sand, coal, or other substance from the interior of a barge or lighter, and after having raised the desired quantity to a certain height it is wished to unload the same into or at any particular place; to effect this a rod, having a cross piece M attached, presses against the top of the shell or trough whilst it is being wound up, obliges it to tilt, as shown, and thus empty its contents into a railway truck, or other vehicle. The steadying wheels, before referred to, are capable of being raised or depressed by means of a screw, acted upon by suitable gearing, so that in transport they can be drawn up out of the way.

PONCINS' STEAM CULTIVATOR.

This invention has been recently patented by Mr. E. Poncins, of Feurs, France.

The apparatus consists of two frames or wheel trains A, B, which work alternately, one for the up travel and the other for the down travel. Each frame carries three tools or implements placed diagonally on different lines, so as to produce three furrows close to each other. The engraving shows three ploughshares *a*, *a*, *a*, on the frame in position for working, and three like shares *b*, *b*, *b*, raised out of the earth. The cultivator is drawn by means of a rope, and is directed so as to produce the furrows desired by the operator on the seat *c*, by means of the rod *d*, which acts on the axles of the front wheels; by this contrivance the driver or operator is enabled to incline the said axles in relation to the axis of the cultivator, and thus drive it in any required direction.

The frame B, which is before the operator, remains inactive during each travel, the shares *b*, *b*, *b*, dragging on the ground being hinged or jointed at *g*. By withdrawing the hinge pins or bolts *g*, any other cultivating tools may be inserted. A line of three furrows having been cut at one travel, the operator turns round on his seat, and the return travel is operated without moving the steam engine, the wire rope and a windlass being arranged to that effect. The tools *a*, *a*, *a*, by pressing on the ground swivel on their hinges and become inactive, whereas those *b*, *b*, *b*, get into action for tilling. The height of the frame above the ground is regulated by means of the set screws *h*, *h*; *m* are blades acting as guards or fingers for clearing away stones.

FANSHAWE'S IMPROVED MODE OF CATCHING FISH.

Mr. H. R. Fanshawe, of Leadenhall-street, proposes to allure and thereby facilitate the capture of fish in the following manner:—

He makes use of a submerged or subaqueous light, the light being derived from electricity, or from the ignition of phosphorized oil or gas; or a sufficient volume of light may be obtained by reflecting light from above upon submerged reflectors.

A globe of glass, either plain or coloured, containing a lamp, is supplied with air by the use of flexible tubing, the said globe being protected by means of a strong wire net or a suitable metallic frame.

The decoy light or reflector is placed or disposed in such a manner at the required depth that the fish are attracted thereto by the light. The illuminating apparatus may be lowered to the required depth, by any mechanical arrangement which will answer the purpose desired, from a boat, having a well at or near the centre, for the purpose of more conveniently superintending the working or adjustment of the decoy arrangement, and of seeing when a sufficient number of fish are collected, so that the boat may be removed for the purpose of closing the net or nets. When the electric light is employed, the lantern may be sunk before ignition, and the light extinguished before its withdrawal.

Where lines are used, as for cod, salmon, and other fishing, it is proposed to employ as a decoy, at or near to the bait on the usual line, a small globe or other shaped vessel of glass, which is illuminated by the introduction therein of luminous fluid, such as common phosphorized oil, or by other means. The upper end of the flexible air tube is supported above the surface of the water by a float. The globe or vessel is protected by surrounding it with a frame or network of wire.

A DIFFERENTIAL WAVE IN A STRATIFIED FLUID.*

This was a curious phenomenon, on which the author had stumbled rather than one at which he had arrived by regular investigation; indeed, the regular investigation seemed to present difficulties greater even than those which attach to simple wave motion. A trough, having plate glass sides and a close cover, was partly filled with water, and partly with spirits of turpentine floating on the water, tinted pink to mark the surface of separation. When the liquids were at rest, this surface was of course level; but by a properly managed effect of disturbance, a regularly formed wave could be propagated in either fluid, traversing the surface of separation, and leaving the top surface almost undisturbed; indeed, it was not necessary that the latter should experience any disturbance whatever, since it was seen that the wave of stratification was then most regularly formed, when the superjacent fluid filled the trough completely, and was in contact throughout with the close-fitting cover. The velocity of propagation was greatly reduced as compared with what it would have been had either fluid stood alone, and this reduction of velocity should probably follow the ratio compounded of the square root of the increase in the work to be done, and of the square root of the reduction in the actuating force. Taking the subjacent fluid as the basis of the ratio, the former component would approximately be expressed by an increment, directly as the specific gravity of the superjacent fluid, and inversely as the thickness of the stratum (since the shallower the channel the less the velocity of wave propagation). The latter component would be obtained by comparing the difference of the specific gravities of the two fluids, with the specific gravity of the heavier. A wave of this character, being a travelling mass or volume of unchanging form, displacing a fluid by pure wave-law as it travels, should be the most correct type of the curve of least resistance. Some of the phenomena developed are suggestive of possible meteorological conditions, since they show how by a wave-motion once established in atmospheric strata of unequal densities, there may be transmitted a state of disturbance under which contiguous volumes of air are mutually urged in precisely opposite directions; the velocity of translation being greatest at the surfaces of stratification. This was curiously illustrated by Mr. Froude's experiment. The continued agitation undergone by the fluids in the creation of waves had developed the singular feature of a froth of the lighter fluid hanging downwards into the heavier, and when the trough was slowly tilted and set down again, so as to develop part of a very long wave of stratification, the opposite translations of the contiguous surfaces rolled up the intervening froth into volumes, closely representing the familiar aspect of a mackerel sky.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

A numerously-attended meeting of members of this society took place in their Rooms, in St. Swithin's-lane, City, on the night of Saturday, the 2nd inst. The chair was filled by Mr. Newton, of the Mint, President, who read a Paper on

Marine Propulsion.

The subject, Mr. Newton said, was one of acknowledged importance, and he trusted that his remarks in reference to it might be taken for what they might be worth, and the plan he advocated criticized freely. It had been assumed by many that the screw system of propulsion must be considered as final; and that only in the direction of improvement in the form of the screw itself, or in the application of twin screws, did there exist hope for obtaining increased and economical speed in steam vessels. He did not altogether share in that assumption, and he trusted that shipowners and marine engineers would give a patient hearing to the statements he intended to make that evening.

Mr. Newton said that his friend Mr. Vaile had proposed to apply to vessels one or more endless-chain propellers, with floats adapted in form, dimensions, and number, to each particular vessel to which they might be attached. Some might urge that there was no novelty in the endless-chain propeller, and that it had been tried and "found wanting." The improvements in the details, and indeed in some of the main characteristics of Mr. Vaile's form of propeller, were such as to distinguish it from all previous efforts of a similar kind. Those improvements consisted in the form of the floats their mode of attachment to the chains, their perfect feathering properties, and the total submergence of the entire apparatus.

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* Abstract of a Paper read before the last General Meeting of the Institute of Naval Architects, by Mr. Froude.

The breadth of the floats might in all cases be made equal to the diameter of the chain-wheels minus the diameter of the shaft and a few inches of clearance. Thus, for example, if wheels of 10 ft. in diameter were used, with shafts of 12 in. diameter, and 6 in. were allowed as clearance, the floats would be 8 ft. 6 in. in breadth, and as long as the beam of the ship would permit.

Now, as every portion of the surface of these floats would be put into the water without exercising any appreciable leverage against the engines, would travel with equal velocity, and have a direct thrust aft, it seemed clear that a far more effective hold of the water must be obtainable than would be the case with screw or paddle-wheel. Up to the present time, it had been found impossible in practice to move vessels at high rates of speed without increasing the penalties of an enormous expenditure of steam power and a ruinously large consumption of fuel. This was owing mainly to the limited area of the propelling surface brought to bear upon the water in proportion to the bulk and weight to be moved through it. Whether screw or paddle-wheel were employed, the results were the same.

In the paddle-wheel the acting surface of the floats was small as compared with the diameter of the wheel itself, and this again was limited by obvious circumstances. Each additional foot of diameter constituted so much additional leverage against the engines, without yielding any adequate advantage. In the case of the screw, this extent of propelling surface was limited by the distance between the keel of the ship and her water line.

The feathering floated endless-chain propeller of Mr. Vaile, on the contrary, admitted of the employment of a number of floats acting simultaneously on the water, and of those floats being of far greater length and breadth than those of the ordinary paddle-wheel.

This was one of the principal features of the plan which Mr. Vaile had invented, and which Mr. Newton now advocated. There were, however, said the reader of the Paper, many others, and among them the complete submergence of the propeller, and its simple yet beautiful mode of producing the feathering movement.

The Paper, which was well illustrated by drawings and diagrams, was followed by a discussion, in which Messrs. Keyte, Onbridge, Briggs, Walker, Miller, M. Jones, and others shared. An adjournment of the further consideration of the subject to the next monthly meeting was finally carried. Mr. Vaile, who was present, successfully combated some objections raised.

Meetings for the Week.

Mon.—*Royal Geographical Society.*—I. "Arrival of the Expedition under Captains Speke and Grant at Khartûm, on the Nile, from Zanzibar." II. "Despatches from Governors Sir H. Barkly and Sir G. Bowen—Landsborough's Traverse of Australia." III. "On Madagascar," by Lieutenant Oliver, R.A., at 8.30 p.m.

Tues.—*Royal Inst.*—"On Sound," by Prof. Tyndall, at 3 p.m.

Inst. Civil Engineers.—I. Discussion upon Mr. Zerah Colburn's Paper "On American Iron Bridges." II. "On the Communication between London and Dublin," by W. Watson, Esq., at 8 p.m.

Wed.—*Soc. of Arts.*—"On the Collection and Utilization of Excrementitious Matter," by J. L. W. Thudichum. II. "On a System of Earth Sewage," by Rev. H. Moule, at 8 p.m.

Thurs.—*Civil and Mechanical Engineers.*—"On Giffard's Injector," by W. Maw, Esq., at 7.30 p.m.

Royal Inst.—"On Geology," by Prof. Ansted, at 3 p.m.

Antiquaries.—At 8.30 p.m.

Royal Soc.—At 8.30 p.m.

Fri.—*Royal Inst.*—"On the Molecule of Water," by Dr. Odling, at 8 p.m.

London Inst.—"On Economic Botany," by R. Bentley, Esq., at 7 p.m.

United Service Inst.—"On Military Surveying," by Major F. R. Taylor, at 3 p.m.

Architectural Assoc.—"On Metal Work. Part II.," by F. A. Skidmore—Illustrated.

Sat.—*Royal Inst.*—"On Language," by Professor Max Müller, at 3 p.m.

The French Academy of Sciences has named Admiral Fitzroy corresponding member for the section of geography and navigation, in the room of the late Sir James Clark Ross.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—W. B. M.—T. J. M.—J. C.—J. K.—J. H.—T. J.—R. S. T.

W. M. (Manchester).—All the advantages of the cellular structure you propose for armour-plating have been obtained in a much cheaper way than by "drilling 12-inch round holes to the depth of 10 in. in plates 12 in. thick, and then plugging these holes up with wood." As you are a mechanic, did you ever calculate the expense of, for instance, drilling out a locomotive tube-plate?

J. C.—The places in London where you can see the printed specifications are—the Free Library, 25, Southampton-buildings; the Patent Museum, South Kensington; the Library of the British Museum; and the Library of the Society of Arts, John-street, Adelphi.

S. W.—Bourne's Catechism of the Steam Engine (Longmans) will probably suit your purpose best. The price is about 6s. or 7s. we believe. The more complete treatise on the steam engine, by the same author, costs about 30s. As you say you wish for information that will be of use to you in a factory, then, perhaps, the work of Mr. Hopkinson on the Indicator, Weale, High Holborn, price 12s. 6d., might suit at a later period of your studies.

J. W. A. S. (Deptford).—Perhaps the main reason that higher pressures of steam are not used in marine engines is the general popular prejudice against high-pressures. The article in our last number, on Compound Engines, will partly answer your question. You cannot practically condense very high pressures of steam with much resulting economy. This must be evident to you on reflection. A cubic inch of water raised into steam of 15 lb. pressure will require about 22¼ cubic inches of water at 50 deg. to get condensed. The very utmost theoretical gain of pressure from a vacuum is 15 lb. There are only 33 deg. less heat in a given weight of water, raised into steam of the pressure of the atmosphere, than if the water were raised into steam of 90 lb. pressure.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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AN ATLANTIC TELEGRAPH.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—I observe the communication of "An Old Sailor," and the further communication of Captain Selwyn, and beg to make the following remarks thereon:—I have first to remark, by way of caution, that new ideas have often been pronounced to be impracticable, though ultimately found to be quite the opposite, and to be highly useful; and it is proverbial, in the history of improvement, that men, apparently the most competent to judge, have often been found to be the most wide from the mark in their first opinions on such matters. It would of course be most arrogant in me to say that "An Old Sailor" and Captain Selwyn are not right, but they may both be wrong, and the probability on this point can only be determined, not from their concurrence in opinion—for concurrence in error is quite a common thing—but from the facts or alleged facts adduced by them in support of their opinion, and their reasonings thereon; which we shall therefore, now proceed to examine.

"An Old Sailor" alleges that there are insuperable difficulties attending the placing of the buoys in such deep water. There may be, but he has not stated what they are. I answered—successfully as I think—Captain Selwyn's specific objection on this point, who, it appeared to me, very strangely assumed that only *one* ship would be employed in mooring the buoys and laying the cable—a most unnecessary limitation. Nor, I suppose, did he keep in view the vast facilities afforded by nature herself in doing so, if we will only condescend so far as to have the plain good sense to adopt the northern route.

"An Old Sailor" further alleges that there are insuperable difficulties in ascertaining the depth to within the number of fathoms I propose to submerge the buoys. On this point I may remark, that I specified a depth of from 20 to 30 fathoms, for the sake of giving an idea of my meaning, and as what would be the desirable depth to aim at; but its perfectly exact attainment in practice could not, it is believed, be accomplished, nor would it be at all essential. The objects in view are—to avoid *surface* motion of every kind, on the one hand; and *great* pressure on the cable, on the other. The former object would be arrived at, according to all the authorities, by mooring the buoys below from 30 to 50 feet under the surface; and on the other hand, the pressure on the cable would be of little moment down to 100 or 200 fathoms, or even more, so that "An Old Sailor" can have all that range if necessary; by means of which, it is supposed, the insuperable difficulties seen by him on this point will disappear, while the objects aimed at will still be attained. But my view, that from 20 to 30 fathoms would be the most desirable depth to moor the buoys, is in perfect consistency with the preceding statement.

I may remark, generally, that alleged "insuperable" difficulties have been so often overcome by skilful selection and adaptation, that it behoves us to be extremely careful when and how we use the word. To state objections is most commendable; in the present case I feel under great obligations to "An Old Sailor" and Captain Selwyn for doing so; but to declare difficulties to be insuperable requires not merely experience or practical knowledge on the particular point (which sometimes, however, it is well known, has a prejudicial effect), it also requires the knowledge of what might be, as well as what is. It often requires us to view the matter from a different point than that from which we have been accustomed to view it, and it also requires the possession of a calm, deliberate, unbiassed judgment.

Having thus examined the facts and reasonings of "An Old Sailor" in support of his opinion that my scheme is impracticable, he and others will judge whether I have not shown, for the various reasons above assigned, that they are groundless and untenable, or, at least, inconclusive. I hope he will favour me with a reply; but, in replying, he will keep in view that the number of the buoys, their size and distance, their depth in the water, and the best means of mooring them are all matters of adjustment. He will also be so good as keep in view that there is such a thing as the northern route with its short-sea distances.

To return to "An Old Sailor's" communication. He says that "weed, barnacles, &c.," would accumulate on the cable, which would thus drag down the buoys so far that the enormous pressure would cause them to collapse."

A telegraph cable, as proposed, is a very different thing in nature, position in the water, use, and, it may be added, in every other respect from a ship's bottom—the adhesion of weed and barnacles to which is what I suppose "An Old Sailor" reasons from. How the matter would stand as to the supposed adhesion of weed and barnacles to the cable would, if necessary, be so far a matter of easy experimental inquiry. But supposing they did adhere, would weed and barnacles be, on an average, heavier than sea water? It is extremely questionable that they would be heavier, to say the least; and, in the meantime, I do not believe that they are. Consequently, if this be so, they would not impair the floating power of the cable, but would, perhaps, rather assist it. But it is also known that weed and barnacles have their limits as to the region where they grow, and, it is believed, that the depth at which the cable would lie, would place it entirely beyond their reach. On these grounds I apprehend no difficulty from weed and barnacles. "An Old Sailor" adds "&c." to the weeds and barnacles, but what that means I do not know, and I question much if he knows himself. I trust that, in making this remark, he will not think me deficient in due respect, as in scientific matters we ought always to be as perfectly clear as possible.

I may here remark, that, when land telegraphy was first commenced, the wires were often laid in the earth—this being then reckoned the best and safest method. This method is analogous to ocean bottom telegraphy. Now, however, land wires are, without exception as far as I know, suspended on poles and carried through the atmosphere—this method being analogous to ocean surface telegraphy. The analogy is both interesting and instructive.

"An Old Sailor" further proceeds in his communication to say that the arguments advanced why a clabe should not lie on the ground, are, he thinks, based on difficulties more imaginary than real. Yet, of the *three* objections—all fundamentally important—stated by me against such a course, he fully and unqualifiedly admits the *first*—namely, the thorough inaccessibility of the cable laid at such a depth for repair.

As to the *second*—the pressure of the great superincumbent mass of water on the cable at such a depth—he reasons, it seems to me, very erroneously, in consequence of not rightly apprehending the facts. He likens the pressure of the water on the cable to the pressure of the air on our bodies; and, as the latter does no ill, infers that the former would do no ill either, but rather good. But it is submitted, that, if it could possibly happen that the air could be entirely excluded from our porous bodies without involving a fatal termination, nevertheless the air, by its constant great weight and great elasticity, would be unceasingly endeavouring to get into our bodies, and would, no doubt, ultimately succeed. So, in the same manner, has the water of the ocean been found to act. Need I remind "An Old Sailor" of the well-known experiment of sinking an empty bottle, tightly corked, a comparatively short way down into the ocean, and, when forthwith brought up, it is found to be full of water, though still tightly corked, thus clearly showing the intense pressure of the water as the depth increases, and its access, through the pores of the glass, into the inside of the bottle. I have also seen it stated, that, when a piece of wood is sunk a good way down into the ocean, it always comes up thoroughly permeated with water, and deprived of all floating power. These most decisive experiments ought fully to satisfy "An Old Sailor," that the *second* objection is as well founded, as he has admitted the *first* to be; and being, from its very nature, a thoroughly fatal objection to bottom ocean telegraphy, I do not see how he, or any one else, should any longer advocate such a worthless system. As for submitting a part of the cable to a pressure of 500 atmospheres, as he proposes, he must recollect that such a pressure, as always applied, lasts for a comparatively short time only; whereas the pressure of the water at the bottom of the ocean never ceases; and, from the excessively insinuating nature of water, must, it is believed, at such a great depth, always ultimately prevail in gradually forcing the water through the pores of the insulating material into the wire, while the electric action of the cable will in like manner gradually cease. This, I have no doubt whatever, is the true cause why deep-sea cables have hitherto always failed, and will fail, so long as they continue to be be laid on the ground. And, if surface telegraphy cannot be realized, we may in that case, give up all idea of ever having permanent telegraphic communication with America across the ocean. Of course, long stretches of continuous cable, such as from Ireland to Newfoundland, aggravates the evils of ocean bottom telegraphy, and brings them all the more speedily to a climax. Hence the reason why the Atlantic Cable, laid between these places, worked for so short a time.

Besides, what has been above stated on this point, it is an ascertained fact, as referred to in a former communication, that pressure diminishes the conducting power of the cable—this, therefore, being an additional reason for preferring surface telegraphy.

As regards the *third* objection to laying the cable on the ground—namely, the utmost uncertainty as to the suitability of the bottom for the cable, "An Old Sailor" seems to think that it is entitled to no weight whatever. This is going too far, though it is believed that there is a great deal of truth in what he says on this point. But, removed so greatly as the bottom is from all observation, we cannot say how prejudicially it may affect the cable at particular places; and there can be, no doubt, that water, as a rule, is much softer than the bottom. On these grounds alone it is highly desirable to keep the cable as much as possible in the water, without touching the bottom, but other grounds might, if necesssary, also be advanced.

I must conclude for the present, as I do not wish to take up more of your space in one number. The preceding remarks, it may be seen, apply more especially to the communication of "An Old Sailor," but I shall beg leave to trouble you with another communication with reference to that of Captain Selwyn's.

H. K.

Edinburgh, 4th May, 1863.

IRON AND WOOD.

Sir,—One of your correspondents (on the 3rd of April) advocating iron, stigmatizes wood backing as good for nothing. He (the iron partisan) is "more convinced than ever that wood backing is a blunder —that it is, in fact, the main cause of the destruction of armour plates under the fire of artillery." Poor wood! This verdict settles his case as a backer, and actually makes him out a culprit. But let him challenge iron to change places with wood, while he (wood) boldly takes his tour of duty in front. Suppose, for instance, the penetrative force of the projectile, and the resisting power of the iron plate, be so nicely balanced, that the former will just carry the projectile through the armour, and expire in the effort. Then let honest wood, in the shape of 18 in. of timber (or a good deal less) meet the shot on its way to the iron, and it is plain that enough of the penetrative force, under the circumstances supposed, would be absorbed to render the projectile harmless to the armour.

But shells (says iron) would set wood on fire. That is not so certain with iron backing, for there would be want of air current. At any rate (rejoins iron) the shell exploding would scatter the wood in fragments. So it might, but the splinters would fly into the sea, and not into the ship through the iron armour.

There would be no harm, nor any great waste of either money or ingenuity, in trying a single experiment or two among the number at Shoeburyness, just to see wood's behaviour with iron armour *behind* him.

Perhaps an iron-plated ship in a wooden hull might prove the best sort of man-of-war to contend with enemies both above and under water—the hostile broadside and the sunken rock. And of the "Birkenhead" and "Royal Charter," there might not be now such piteous tales to tell if they had been sheathed with timber. *Larch* is said to be slow in taking fire; and if that is true, as it is lighter and more buoyant than oak, would it not be preferable for the outer hull of an iron ship?

One of the "Lignums."

May 1st, 1863.

THE VALUE OF WOOD BACKING TO ARMOUR PLATES.

Sir,—In your account of the proceedings at the Institution of Naval Architects, it is reported that Mr. Scott Ruesell, in the Paper he read at the meeting, stated that the timber backing to the armour of the "Warrior" did no good, and that the weight of this wood would be better exchanged for iron plating. It is surprising that a gentleman of the practical knowledge which he must necessarily possess, should utter the former of these opinions. It would really seem that he entertains the extraordinary notion, as false in theory as it is contrary to all experience, which your correspondent "Civilian" advocates—that elasticity is an evil and rigidity is a benefit, when the object is to prevent a shot penetrating the armour—unless, indeed, he limits his idea of the inutility of wood backing to the incidental evil of favouring (not wholly producing, it should be remembered) the fracture of the bolts that fasten the plates. But this evil being merely of a practical nature, is susceptible of practical remedies. The second opinion, however, if it implies no more than, that weight for weight, the resistance opposed by wood is less than the resistance opposed by iron to the penetration of shot, and that, in reference to this particular alone, wood might be better exchanged for iron, involves only an unsettled point of inquiry deserving experimental investigation. In my discussion with "Civilian," I always treated it as an open question, but I will now, for the sake of argument, admit that wood is inferior to iron in this respect, and yet the question will still arise—can wood backing be dispensed with? I think not; and I give this opinion, not now because of the greater difficulty which an elastic resistance, as contrasted with a rigid resistance, presents to the piercing of the armour plates, for I am assuming that they will be so improved in quality and increased in thickness that even a 300-pounder will not be able to force a passage through them, but because I have in view the disastrous effects of such heavy projectiles in the way of concussion, by breaking up the iron framing of the ship, if the blow be not softened, and also if it be not distributed over as large a surface as possible.

It is the intensity rather than the magnitude of the shock—the latter being, in truth, unalterable—that snaps the fastening bolts and the iron girders, and it is folly to contend against it, under the conditions of buoyancy which the case imposes upon us, by sheer strength of resistance. We must manœuvre with the foe and oblige him to change his front. Although our engineers, being most conversant with the property of rigidity in iron, may be supposed to regard it with the affection of the currier for his leather, and although habits contracted in the pursuit of abstract science might have a lingering influence upon the judgment of the more scientific among them, yet surely the latter might have brought to their recollection how the more practically minded of their confreres interpose buffers between railway carriages and fenders between ships. In fact, we must adopt yielding tactics with such an enemy as impact, and not brave it out with rigid solid resistance; we must give sensible duration to what otherwise would be the almost instantaneous act of impact, by prolonging opposition to it in distance in the direct line of the action; and we must also involve it in operation over a greater area of resistance than that of the initial collision, that is to say, we must distribute the action of impact over greater time and greater space, not only to obstruct the piercing of the armour plates (which, however, is not the point I am now discussing), but for the purpose of preventing the blow from being transmitted with the same intensity with which the outward surface is struck. This distribution and diffusion of the hostile force is the natural course to take to defeat that concentration of it in time and space which the artillerist adopts against us—the first, by giving the greatest velocity to the shot; and the second, by throwing the greatest weight into it under the same area of impact, by making it take the form of a bolt instead of a sphere.

The effect of this concentration, in respect to the piercing of the armour plates can be defeated, at least it is possible; but the concussion of the impact is inevitable; and it is the destructive tendency of this upon the ribs and skeleton of the ship, or upon the turrets of the "Monitors," on which our American cousins rely, and which prompts them to cast such enormous guns. Neither can the magnitude of the concussion be lessened by any contrivance which does not cause the shot to glance; for it must wholly correspond in this case to the *vis viva* of the projectile, there being no deduction here in regard to relative velocity. But, on the other hand, the character of the concussion can be altered, and its destructive tendency mitigated, by a change in its form—that is to say, the intensity of pressure, potential at the moment of impact, and actual if meeting with adequate resistance, can be moderated, in the course of its transmission through the side of the vessel, by an alteration in the relative value of the terms of the action, considered as the performance of work. This, first assuming that we are speaking of uniform, or, if otherwise, of mean resistances, an actual pressure for a distance of 3 in. against the resistance of iron armour (being, say, 2 in. in the indentation, and 1 in. in the deflection of the plate), will find its equivalent in one-half the pressure for a distance of 6 in. against the integral resistance of a wood-backing (say, of 20 in. thick), in opposition to deflection to the extent of the said 6 in. Thus, the terms differ, whilst the amount of work done, being the product of the terms, remains the same. Now, this taking of the lineal measure (tantamount to the diffusion of action over time), is on the assumption that the area of resistance will continue the same, which of course, is not the fact; nor, is it so, even in the case of the passage of shot through wood. But, it is also assuming what is doubtful, touching timber backing, that the necessary degree of rigidity proper for the frame of a vessel, will admit of a deflection of 6 in.; but this want of exactness in the illustration will not affect the argument. The pressure, it will be seen, does not terminate with the initial action, but is propagated, not only through the side of the ship, but throughout the entire vessel, and thence, indeed, to the water, and so on to whatever extent pressure is communicable. This proposition is, however, subject to the qualification that the action may, to a certain extent, be spent by transformation into molecular phenomena, as indeed is sensibly manifested in this very case, when heat, light, and perhaps electricity, are evolved in a flash on the shot striking the plates.

The pressure being diffused by propagation, its intensity will not only be diminished for a given area upon any material subjected to it, in proportion to the greater distance over which integral resistance is oppossd to it, but also in proportion to the greater area over which it ultimately acts. Now, the ultimate area—ultimate I mean so far as we are practically concerned—is enlarged proportionally to the square of the distance from the apex of the truncated cone, formed between this area and the initial area of the impact, the distance between the two being the thickness of the side of the vessel. But the extent of the enlargement will depend also upon the angle at which the pressure diverges, and that again upon the nature of the materials through which it is transmitted, and also, as I apprehend, upon some ratio, inversely however, of the velocity with which the blow is struck. Thus the work done in the concussion will be diffused in superficial as well as in lineal space. For example—let the initial area of the impact be one square foot (rather exceeding that of a 13-inch shot), and the pressure on the skin be distributed, in virtue of the angle of divergence and of the thickness of the backing, over a surface of 4 square feet, then, if the deflection being equal to the range of the pressure in and of the armour plate, namely 3 in., the stress on each square foot will be one-fourth of the intense initial force of the impact, and one-eighth of the same, if the deflection be extended to 6 in., in accordance with the suggested lineal modification of the work. And as to a rib supporting this area, the stress on each foot of its length will be respectively for these deflections, one-half and one-quarter of the pressure of impact. If the frame of the vessel were made as rigid as "Civilian," Mr. Scott Russell, and others appear desirous of rendering it, so that it permitted only a slight deflection (say of 1 in.), then the foot lineal of the rib opposite to the square foot of the collision, would have to sustain three times the intense initial pressure of the impact, if the wood backing were removed, and one-and-a-half time if allowed to remain. Each square foot on the skin would have to sustain three-quarters of the same pressure.

We thus see the immense effect, whether this calculation be exact or not, which the presence of rigidity and the absence of backing have a tendency to produce in the fracture of bolts and iron ribs. I am aware that something may be said in the way of modifying this view of the subject, in favour of conclusions leading to a medium beneficial result, as between intensity of pressure on the one hand, and extension of the strain on the other; but then it would be necessary to disprove that it is the *jar*, or the suddenness of the strain which causes the iron to snap. Besides, it would be allowed by such objectors that suddenness doubles the strain. I believe it does more than that, if anything at all, but I cannot now enter upon the subject.

It is possible, and, if I mistake not, it is found to be the fact, that in the passage of pressure the integrity of the wood in the backing is destroyed in the immediate vicinity of the blow. This destruction would be gladly accepted vicariously for that of the iron girders, but, unfortunately, it has not that effect, for certainly it tends to diminish, without wholly checking, that divergency of the pressure which distributes it over a larger area; for divergency in some degree would take place even in a backing of sand. It is also so unfavourable to, as it would be wholly destructive of, the integral resistance of the backing, if it extended to the length and area of the pressure through the wood. These considerations, however, seem to account for the appearance of a small area at the back of the targets, showing signs of a greater comparative intensity of pressure relatively to the larger area surrounding it, and also a more circumscribed pressure upon the whole than we should have expected to find.

Allow me to make one more incidental remark. The mathematical ideas embodied in this exposition of the subject are these:—that *vis viva* is transformed into work; that work is transmitted from body to body, such bodies being rigid systems of particles; that in such transmission there is no sensible loss, whatever may be the fact in the transformation; and that the terms can be changed with perfect equivalency from a greater pressure over a lesser distance, to a proportionally lesser pressure over a greater distance. Now, these ideas, and all needful practical deductions therefrom, can be expressed without necessarily using symbols, and adopting an algebraical treatment thereof, and be brought home, in ordinary language, to practical and even popular apprehension.

Yours truly,
BENJAMIN CHEVERTON.

P.S.—Since this letter was written, Mr. James Chalmers' target has been tested, affording a singularly appropriate illustration of the preceding observations. An explanation of the efficiency of this target may be drawn from a consideration of the penultimate paragraph of this communication. The alternate layers of iron and wood, firmly bound together, besides being connected by a base plate, and presenting their edges to the pressure, tend to preserve the integrity and elasticity of the wood, and to maintain intact a rigid system of particles, so as to yield an integral resistance of the entire body thus treated, to the exclusion of destruction in detail, and the transmission of pressure from particle to particle. A more elastic resistance is thus established. Doubtless, also, the ultimate area of the pressure is incidentally enlarged. But this is not the point to which I attach importance; for, as I have already said, there will exist an angle of divergence even through a backing of sand. I really cannot help making the remark, that I not very long since recommended in your pages this very arrangement of wood and iron for the construction of the frame of vessels, and that upon it, as a foundation, I proposed to place the armour-plates.—B. C.

NAVAL CONSTRUCTION AND DOUBLE PROPELLER SHIPS.

SIR,—Observing in the last number of the MECHANICS' MAGAZINE an article on "Twin Screw Steam Ships," in which reference is made to the interesting Paper lately read before the Society of Arts, by Commander Symonds, on the subject, I trust you will do me the favour to allow space in your valuable columns for the following:—

It may be generally supposed that the mode of applying two screws, as Commander Symonds and Mr. Roberts advocate, is the only practicable way of applying them, but such is not the case. It has, however, one advantage, that is, that no other method has yet been tried, and, so far as the late experiments have gone, this system of propulsion has proved to some extent a success. These experiments, however, have only been made upon very small vessels. The inquiry that will follow, as a matter of course, will be how the system is likely to answer for ships of the large class, intended for high speed, and consequently having long tapered after-bodies. In such a case, the propeller shaft projecting from the run at the end of bilge must necessarily be of great length, and, whilst more exposed, will require several stays or supports, which we shall be obliged to secure to the body of the ship, offering as they would immense obstruction to the free flow of the fluid from the after-body of the ship in motion. At a slow speed this is not important, but at a great speed these supports or frames will greatly impede the ship's progress. Worse than that, they are liable to be carried away, and then what becomes of the screw shaft? The plan Commander Symonds advocates may suit small vessels with a full and short run, but it will never do for large ships intended for speed.

About the beginning of March, 1862, my attention was drawn to the reports of the trials then being made with the new iron-clads, and the unpleasant discovery that considerable difficulty was expended in making them steer. The question again and again recurred, how was it that these ships, having such beautiful and noble forms, and fitted with every available appliance for facilitating their steerage, would not answer their helms as promptly as other ships? No reply to that query seemed so satisfactory as the one that the cause was owing to the weight of solid metal upon their sides. In the endeavour to find a remedy, or a means to make them perform their revolutions rapidly, I thought of applying two screws—namely, "one under each quarter," and then the idea of double or bi-formed after-ends was evolved, which brought with it a train of other ideas that are likely ultimately to bring into existence a totally new form of ship, adapted both for the Navy and the mercantile service. A model of mine is now on view at the South Kensington Patent Museum, put there last October, which was made with the object of showing the double after-ends of the two keels, extended and meeting at the centre of bow, about the light line of flotation, supplying a new idea for a bow which is hollow or concave before it meets the flat bottom, and thrown back above the water-line, to prevent the seas passing over the rail on to the deck—a sea would divide itself and fall at each side before it could reach the rail. The form of the ship beneath and above the plane of flotation has been since somewhat modified, as it has been found necessary since to mature and perfect the form to attain certain objects to which space forbids me now adverting.

The present style of model belongs eminently to ships to be propelled by sails, and partly suited for paddle-steamers, but not at all for screw ships. In the first, we want the greatest lateral resistance attainable, and so must have the long and deep forefoot and great depth of deadwood aft, and the ship must sit deep in the water to enable her to "hold her own" when the wind blows across the beam, which is nearly always the case. These conditions are not required for the ship to be propelled like the fish, whose propeller is precisely in the same place and in such a position that it drives all the impeding forces before it. Therefore the curves of the longitudinal sections of the after body must correspond in their form and fine taper to those belonging to the fast fish, if the force of suction may be done away with, which we find to be so formidable an impeding force where it exists, as it does in badly formed ships and those having a short and full run, or after line, especially near the loaded section. In sailing ships this fulness cannot be dispensed with, if we have only one after-end, from the danger of pooping in running before gale. In the present style of ship, the force of suction commences just below the surface of the water, and diminishes in strength and area in the direction of a diagonal section towards the bilge. In the case of finely-tapered lines aft, its area is much reduced, and can only exist within a very narrow compass immediately below the surface, whilst the ship is sailing at a moderate speed; but increase the speed, and its area spreads, following the line mentioned, its strength becoming greater in proportion to its increased area. Secondly, the area of friction is confined to the bow and that portion of the ship's side bounded by a direct line, or it may be a curve, according to the form of the body, which we may produce in our imagination, from a point a little abaft the forefoot to the knuckle of the quarter, its intensity being greatest on that portion of the bow between the stem and the cheek. A long fine bow upon a clipper ship may look very pretty, and be an advantage to her in gaining lateral resistance and so afford the weatherly qualities, so desirable in a sailing ship; but it will not be favourable to speed, since the area of friction has thus been so much extended; and it becomes a question of some doubt whether even a long bow line, under these circumstances, tends to increase lateral resistance; for if the other impeding forces were reduced to their minimum, and so that the ship may pass through the fluid more quickly, she would make up for any deficiency of lateral resistance afforded by the long bow line and upright stem. The element of friction in long ships with great length of bow line, becomes of considerable importance.

In screw-propeller ships we do not require a long fine-tapered wedge bow, though the straight line is better than the concave line, since we have no occasion to think how we may best obtain weatherly qualities; in her case we want to apply the form of least resistance to her progress direct ahead. She is not intended to travel partly sideways, as the crab, but to go right forward, like the fish. Let us take a fast fish for our model. What is the form that the God of nature has given it? and what provision has He made for its movements through the silent deep—its habitation? The fast fish will supply us with beautiful curves, and a perfect form for a fast and safe ship, if we will but copy the model so placed before us. Suppose we take a porpoise or bointa, or any other fast sea fish, and cut it into sections, and suppose the transverse sections of this fish approximate nearest to the ellipse, then let us adopt the ellipse in procuring curves for the transverse sections of our ship. If, again, the longitudinal sections of the fish correspond nearest to the parabola, then let us apply these curves to the longitudinal sections of the ship's design we are engaged upon; and so we may now employ the science of Conic Sections in producing a ship's design with considerable advantage. Conic Sections could not be applied to shipbuilding before, simply because we did not want the curves for the design of a sailing ship, as the propelling forces are so often executed across the longitudinal axis of the ship. But now we are endeavouring to procure a design for a ship which must go before the propeller. We shall not have two forces, one acting against the other, as we find in the case of a ship with the wind abeam.

But the questions may be asked: How do you intend to make a ship sit upright if you adopt the fish as your model?—a body formed like the fish would cant upon its side unless weighted so as to maintain a central position, and this would not always be convenient. And again, if you adopt the long and finely-tapered line, such as we find in the fish, it would have so much buoyancy at the fore-end, and so little at the after-end, that the stern or tail would settle down in the water, and the fish's head would be found in that position which we should fancy it to assume if about to make an astronomical observation by gazing at the stars. The answers are as follows:—1st. We split the fish into two sections by a vertical plane its full length. 2nd. We separate them apart, say a distance equal to the semi-conjugate diameter of the ellipse, or the whole diameter, or three-fourths, as we should find most convenient, just according as we want the ship to float in shallow water and turn round quickly; the transverse diameter of the ellipse being vertical. We retain these conditions of the ellipse in applying this figure to the drawing.

We join the fish again by means of another set of curves, which, however, may be also got from Conic Sections; and so doing we have converted the fish into a monster of the deep; for it now has got two tails. The buoyancy of those two tails make up for the loss of buoyancy we should have experienced with but a single tail, and having removed a quantity of displacement under the breast of the fish, which will let the water meeting it slip freely under the belly, the two ends we have thus managed to balance. Our propeller shafts will be safe, as they are enclosed and protected, and offer no obstruction to the fluid passing along the run. We can gain a high speed and diminish the disagreeable and destructive motions, namely—rolling, pitching, plunging, and scending; these will be rendered so exceedingly smooth and easy that they will be scarcely felt. The ship will draw less water, at the same time affording greater displacement. The propellers we shall fit on to the shafts having great traction powers, with extraordinary propelling power, we can bring the ship up in her own length, and so back out of danger, when in action, if the necessity occurs, and turn her about quickly. The turret or shield system of defence she does not need, as her broadside guns can be trained as readily as the guns in a revolving turret. It becomes, therefore, a matter for the serious consideration of this country, when it is known that one good and perfectly constructed ship of war is of greater value (though she need not be of great dimensions) than a dozen badly constructed ships.

I am, &c.,
JOHN KENNEDY.

Shipbuilding Yard, Whitehaven,
6th May, 1863.

Miscellanea.

On Monday last, at the general monthly meeting of the Royal Institution—William Pole, Esq., M.A., F.R.S., Treasurer and Vice-President, in the chair—the secretary announced, that His Grace the President had nominated the following Vice-Presidents for the ensuing year:—Sir William G. Armstrong; William Pole, Esq., M.A., F.R.S., Treasurer; the Rev. John Barlow, M.A., F.R.S.; Sir Henry Holland, Bart., M.D., D.C.L., F.R.S.; Sir Roderick I. Murchison, K.C.B., D.C.L., F.R.S.; and the Lord Wensleydale. John Graham, M.D., and Cosmo Howard, Esq., were elected members of the Royal Institution. The following professors were re-elected:—William Thomas Brande, Esq., D.C.L., F.R.S., Hon. Professor of Chemistry; John Tyndall, Esq., F.R.S., Professor of Natural Philosophy. Edward Frankland, Esq., Ph.D., F.R.S., was elected Professor of Chemistry.

The following gentlemen were elected officers of the Manchester Literary and Philosophical Society for the ensuing year:—President—Edward William Binney, F.R.S., F.G.S. Vice-Presidents—James Presctt Joule, LL.D., F.R.S., F.C.S., &c., Robert Angus Smith, Ph.D., F.R.S., F.C.S., Joseph Chesborough Dyer, Edward Schunck, Ph.D., F.R.S., F.C.S. Secretaries—Henry Enfield Roscoe, B.A., Pe.D., F.C.S., Joseph Baxendell, F.R.A.S. Treasurer—Robert Worthington, F.R.A.S. Librarian—Charles Frederick Ekman. The Council—Rev. William Gaskell, M.A., Frederick Crace Calvert, Ph.D., F.R.S., &c., Peter Spence, F.C.S., George Mosley, Alfred Fryer, George Venables Vernon, F.R.A.S.

A new iron steamboat, built at Messrs. Rogerson's yard, St. Peter's, Newcastle, for the Tyne General Ferry Company, was launched on Monday. As a compliment to the renowned champion of the Thames and Tyne, this boat was to be called the "Robert Chambers." She had not yet been furnished with her engines and chimneys, but when she is fully equipped, as she will be, with machinery manufactured by Messrs. Hawks, Crawshay, and Co., she is very likely to prove one of the fastest boats of this rapid Red Star line. She is 99 ft. in length, 14 ft. beam, and 6 ft. 6 in. deep, and will be propelled by oscillating engines of 20-hoere power.

To the many and varied manufactures already existing and thriving in Birmingham another is about to be added—that of making files by machinery. A company has recently been formed to establish the new trade; its first works are to be erected in the neighbourhood; and as there is promise that the shares will be taken up, it is likely that operations will be commenced at no very distant period. Hitherto file-making has been one of the staple trades of Sheffield, but owing to the foolish, if not criminal, refusal of the Trades Unions of that town to permit the use of machinery in the manufacture, there has been a growing danger that the trade would be lost not only to Sheffield but to England. The Company intends to purchase the patents of Mr. Greewood, of Leeds, and of M. Bernot, of France.

SAFETY APPARATUS FOR GUARDING MINE SHAFTS.—Our attention (says the *Glasgow Morning Journal*) has been called, *apropos* to a letter which appeared in our columns on Monday last, from "A Miner" at Barkip Colliery, to an invention of Mr. William Reid, of Mount Vernon Colliery, by which the frequent fatalities to miners in ascending and descending shafts may be effectually prevented. As applied to an ordinary coal-pit mouth, the apparatus consists of an open rectangular timber frame, large enough to embrace the opening at the head of the shaft. This frame has its two ends hinged on so that it can be easily opened out for adjustment in its place, without interfering with the winding rope or cage. When the cage is down the shaft, this guard frame stands upon the pit mouth, so that nothing can fall down the shaft; but, when the cage is wound upwards, projections upon the cage come in contact with the feet of the frame, and lift it up clear of the pit's mouth. This action carries the guard frame clear away from the pit's mouth, so as to allow of full access to it, whilst, at same time, the cage itself forms the guard, and prevents anything from falling down the shaft. In this way a most effective guard is kept over the pit's mouth at all times of the actual working of the pit, whilst, at the same time, the protective apparatus does not in any way impede the operations of the miners or attendants.

TELEGRAPHIC COMMUNICATION WITH AUSTRALIA.—Two projects are in the field for connecting Australia with Java. It is proposed to lay the cable on the north-west of Australia, on the shores of the Gulf of Carpentaria, or to take it round to Brisbane, the capital of Queensland. At this point the cable would be in communication with the existing intercolonial lines; and New South Wales, Victoria, and South Australia would be thus brought into connection with the countries of the old world. The cost of laying the line from Java to Queensland is estimated at £1,100,000; but from Java to the north-west a cable could be laid for £243,000. Considering the many risks to which the submarine cables are exposed, and the uncertainty of their action, there can scarcely be a doubt as to the policy of selecting the cheaper route. The cost of such a land line has been estimated at £120 per mile, or for the whole distance from the north-west coast to Adelaide a sum of £177,000, which would make together a sum of £420,000 as the cost of the complete system from Java to Adelaide.

MR. LAIRD'S BILL FOR TESTING ANCHORS AND CABLES.—Mr. Laird has introduced a bill into Parliament for enforcing a standard proof to be applied to merchant ships' anchors and chain cables, and for the testing thereof prior to sale by the manufacturer or dealer. It is scarcely necessary to state that it is most desirable for the preservation of life and property that the anchors and cables used in the merchant navy should be of the best quality. This can only be secured by a public test, under proper supervision, and the bill provides for powers to the Board of Trade to license public testing establishments for this purpose, and to secure proper control over them by seeing that the testing machinery, &c., is kept in proper order, and that the various bodies licensed to erect testing machines carry on their business in an efficient manner. The duties of the Board of Trade, as proposed in the bill, will be very simple, being confined to licensing proper parties, and to seeing, as above stated, that the machinery is in an efficient state for the purpose contemplated. The charges for testing will also be subject to the approval of the Board of Trade; and there is a clause enabling owners of cables or others who may be aggrieved by the conduct of owners of testing machines to memorialize the Board of Trade, who are authorized to make inquiry into the matter complained of. The bill also provides that it shall be unlawful, by a certain date to be fixed, for dealers to sell unproved anchors and cables. The act is intended to apply to all British vessels, propelled by steam or sail, engaged in the foreign, colonial, or coasting trade; and the test to which anchors and cables are to be subjected is the standard adopted by the Admiralty, which has been found to answer, and to secure a very superior article, thoroughly efficient in every way. A parliamentary committee sat in February and March, 1860, under the chairmanship of Sir James Elphinstone, to inquire into the manufacture of anchors and chain cables for the merchant service, and made a report strongly in favour of a compulsory test.

On Saturday last the foundation stone of the new bridge at Blackfriars, was laid by Lord Sondes. This bridge will form part of a connecting link between the London, Chatham, and Dover and the Metropolitan or Underground Railway. A large passenger station will be erected in close proximity to the southern abutment of the bridge. It will be called the "Blackfriars Station." The bridge will have five spans, the centre one being 188 ft., the second and fourth are 177 ft. 8 in., and the first and fifth are 163 ft. span. The abutments will be of brickwork, cased with Portland stone, and the foundations are taken down to the London clay, at a depth of 27 ft. below Trinity high water. The first stone is laid at the level of low-water mark, or 18 ft. below high water. The abutments are built in coffer-dams of the ordinary construction, which are the largest ever executed in this country. The piers, four in number, are of a somewhat novel construction, and the method to be adopted in their erection has never been before attempted. The foundations for the piers will be laid at a depth of 55 ft. below Trinity high water; and in order to get to this depth without the expense and inconvenience of coffer-dams, large wrought-iron caissons, 18 ft. in diameter, are sunk into the bed of the river till the required level is reached, when the brickwork is commenced inside them, and carried up 2 ft. below low-water line. At this point the masonry of the piers commences, and this is laid within a temporary caisson to 5 ft. above Trinity high water. The temporary caisson will then be removed. From this height to the level of under side of girders, the piers consist of clusters of cast-iron columns, of which one will be under each girder; and as there are three girders throughout the length of the bridge, the bridge will consequently consist each of three such clusters of columns. The girders, on the lattice principle, will rest on the tops of the columns, and the headway afforded for navigation will be 30 ft. 3 in. above Trinity high water. The coffer-dam of the north abutment is already in a very forward state. The three large caissons at the first pier on the south side are lowered into the bed of the river, and the divers are now employed sinking them to their proper depths, preparatory to commencing the masonry of the pier. The timber piling staging for the other piers is in a forward state, and will soon be completed and ready for placing the caissons in their proper positions. The bridge is expected to be ready for traffic in May of next year. Messrs. Cubitt and Turner are the engineers; and Messrs. Peto, Brassy, and Co., the contractors.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 2754, 2789.
BOILERS AND FURNACES—*none.*
SHIPS AND BOATS, including their fittings, 2759, 2767, 2782, 2797, 2798.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2752, 2753, 2758, 2766, 2776, 2781, 2789.
CULTIVATION OF THE SOIL, including agricultural implements and machines—*none.*
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2748.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2763, 2764, 2765, 2779, 2783, 2786, 2787, 2792, 2793.
BUILDINGS AND BUILDING MATERIALS, 2746, 2773, 2778.
LIGHTING, HEATING, AND VENTILATING, 2745, 2770.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2742, 2743, 2749, 2750, 2757, 2761, 2768, 2769, 2775, 2777, 2791, 2794, 2796.
METALS, including apparatus for their manufacture, 2760, 2774, 2780.
CHEMISTRY AND PHOTOGRAPHY, 2756.
ELECTRICAL APPARATUS, 2772.
WARFARE, 2744, 2747, 2755.
LETTER-PRESS PRINTING—*none.*
MISCELLANEOUS, 2751, 2762, 2771, 2784, 2785, 2788, 2795.

2742. E. J. Franklin. *A combined spring tape measure, needle case, and pincushion.* Dated October 11, 1862.

The body of this combined instrument consists of a hollow rectangular case or box, in a portion of which the spring tape measure is contained, the said spring tape measure being of the ordinary kind. The pincushion is formed upon a portion of the edges of the said case or box, that part of the interior of the box or case not occupied by the spring tape measure being filled with sawdust, wool, or other material to retain the pins inserted into the pincushion. On the sides of the box or case containing the tape measure and pincushion flaps or covers are situated, one or both of which may open from the case after the manner of the cover of a book. Between the moveable flap or flaps and box or case pieces of fabric are placed, into which the needles are inserted; or openings or recesses may be made in the inner sides of the flaps for the reception of packets of needles. *Patent abandoned.*

2743. A. Vennedy. *An improved composition for covering and forming the tips of umbrellas and parasols, also applicable to covering the ribs and stretchers of the same.* Dated October 11, 1862.

This invention consists in the employment of the following substances for producing a composition suitable for covering or forming the tips of umbrellas and parasols, and for coating the ribs and stretchers of same with a view of ornamenting them. The ingredients employed are paste, sealing wax, shellac, sulphur, varnish (the latter substance may, in some cases, be dispensed with), or substances of a similar nature, or made from a combination of one or more of the same. *Patent completed.*

2744. R. A. Brooman. *Improvements in breech-loading firearms.* (A communication.) Dated October 11, 1862.

This invention relates to those breech-loading firearms in which the Lefaucheux cartridge is used with detonating powder for ensuring central fire, and consists—1, in arrangements of piston and hammer for exploding the cartridge, and for withdrawing the piston; 2, in an improved means of forcing the cartridge extractor to protrude beyond the rear of the barrels upon the same being tilted; and, 3, in an arrangement for extracting the cartridge in single barrel guns and pistols. The exploding piston is hinged or attached by a pin on a horizontal plate, or it is formed in a piece with the plate, which carries on the outer side a projection, against which the face of the hammer strikes to drive forward the piston and explode the charge. The plate also carries a stud or projection farther back than that first mentioned, which lies in a curved slot formed in the side of the hammer. On raising the hammer after firing the gun, the stud and consequently the piston are withdrawn. For forcing the cartridge extractor to protrude the inventor fits on the bolt, on which the barrel and forepart of the stock are free to tilt, an upright plate, formed with a notch on the under part. On the barrels being tilted, the fore end of the back part of the stock coming against the notch on the plate, forces the upper part of the plate forward, which, coming in contact with the fore end of the extractor, causes the rear end thereof to be protruded. For single barrel guns and pistols he makes the barrel to turn upon a pin passed through an aperture in a lump formed in a piece with the rear end of the barrel, and pushes back a hooked rod engaged under the flange on the cartridge; on withdrawing pressure from the rod a coiled spring returns it to its original position. *Patent completed.*

2745. W. Catchpool. *Improvements in fire-escapes.* Dated October 11, 1862.

For the purposes of this invention, the inventor employs a basket or frame adapted to receive the persons about to escape. This basket or frame may be made of metal, or other open work, to give lightness to it, and may have a temporary top, so as to be generally used as a table or sideboard, and it is provided with several chains or cords, by which it may be suspended from a central ring or connection, with one end of a main supporting chain or rope, the other end of which is attached to a spindle which may be applied to the window, or other opening from which escape is to be effected. Upon this spindle is applied a pulley, acted upon by a friction band or brake, so that a person in the place from which descent is to be effected, may, by acting on this friction band or brake, regulate the speed of descent of the basket or frame, or by a separate chain or cord the party descending may regulate the speed of descent. He also forms the spindle from which the chain or cord is unwound in the descent of the basket or frame of a progressively diminishing diameter, from one end to the other, thereby to avoid the tendency to a progressive increase of velocity, arising from the action of gravity during such descent. And he also forms the ribs of the basket or frame curved, and inclining inwards at the bottom, and when it is formed of several sides, the surfaces between the ribs are inclines inwards, by which facility is given in passing cornices or other projections from the surface of the structure. *Patent abandoned.*

2746. J. Durant. *Improvements in the form and construction of chimney tops, or appliances for surmounting chimneys.* Dated October 11, 1862.

This invention consists in forming the chimney can so that its base may be eitheir circular, square, or polygonal; the stalk, or portion above the base, is preferably cylindrical in these parts. The patentee does not claim anything new in form or construction. The upper portion of the stalk is encircled by a corrugated conical cap, the lower end of which, with the corrugations, cover, project over, and encircle the upper portion of the stalk, the upper part of the conical cap being of nearly the same diameter as the stalk, which it also encircles and rises above. On the outside of the upper portion of the conical cap is fixed another corrugated cap of rather smaller dimensions than the last mentioned. The effect of the corrugations of these caps is to form channels on the outside, which causes the exterior atmosphere to rush through the different channels upwards, and in like manner the air, instead of passing downwards, is carried off by the same chamber. Within a small rib or bar over the top of the can is suspended a double conical valve or float; the spindle of the valve passes through an eye or slip in the rib, and allows the valve to rise or fall. When acted upon, the diameter of the valve being less than the top of the can, the smoke reflected from its conical surface passes easily off, and similarly the down draft is carried through the corrugated channels of the comb; the brush, in the cleaning of the chimney, can also pass fairly out at the top, the valve being raised up by it above the level of the mouth. *Patent completed.*

2747. T. Bouch. *Improvements in machinery or apparatus for charging or filling cartridges.* Dated October 11, 1862.

Under one modification this apparatus consists of a metal frame, which can be readily fixed to a bench or table by means of a pinching screw. Extending up from the back part of this frame or base is a bracket which supports a hopper divided into cells for containing the powder and shot to be filled into the cartridges. The supply of powder is placed in each alternate cell of the hopper, and the shot in the intervening cells. The hopper is fixed to a rectangular chamber of a trough-like figure in its transverse section, into which the feed aperture at the bottom of each cell of the hopper opens, and there are openings in the lower part of the chamber which communicate with tubes that serve to convey the powder and shot alternately into the cartridges. The chamber is fitted with a sliding-piece, which has tubular chambers formed in it, corresponding to the number of powder or shot cells contained in the hopper. These tubular chambers have a cubical capacity exactly equal to the measure of powder or shot required for each charge, and are so arranged that, when the sliding-piece is drawn to the right, for example, the chambers are brought under the powder cells, and the powder falls into the sliding-piece, and into the tubes beneath. The escape of the shot is meanwhile prevented by the solid face of the sliding-piece being beneath the apertures of the shot cells. The movement of the sliding-piece to the left shuts off the powder cells, and brings the tubular chambers under the shot cells, which now descend into the tubes. The quantity of powder and shot thus fed into the tubes is regulated by the size of the chambers and tubes, so that the cartridges filled by means of the machine are exactly uniform in this respect. The paper cartridges to be filled are placed in vertical cells formed for the purpose in the front of the base piece or main frame in a vertical line with the powder and shot tubes, and are enclosed by a hinged door-piece, which is fastened by a catch during the filling operation. At the back of the hopper are arranged two or other number of vertical tubes for containing the wads to supply each cartridge as it is filled. These tubes are each fitted with a spring presser to force down the wads, and they are brought forward over the cartridges by means of duplex sliding-pieces, which are arranged to bring the thick and thin wads alternately into the cartridge. The thick and thin wads are arranged alternately in the feeding tubes, so that when the charge of powder has been allowed to fall into each cartridge, the duplex slide is pulled forward, and draws a thick wad over the cartridge. The powder and wad is rammed down by means of the filling tubes, which are made moveable, and connected to a cross-head having laterally projecting handles, and working on vertical guides. The operator depresses the cross-head, which causes the tubes to descend and drive the wads down upon the powder. The cross-head and filling tubes are kept up firmly to the chamber below the hopper by helical springs surrounding the guides, or by other equivalent means. The duplex and slide is pushed back, and the charge of shot filled into each cartridge by shifting the filling slide to the left, and the lower plate of the duplex wad slide is drawn out, which brings a thin wad over each cartridge, and these wads are pressed down on the shot by means of the cross-head. The final operation is to roll in the end of each cartridge so as to prevent the escape of the wad and contents. *Patent completed.*

2748. A. V. Newton. *Improvements in evaporating apparatus applicable to the manufacture of sugar.* (A communication.) Dated October 11, 1862.

In constructing evaporating apparatus according to this invention, the bottoms of the pans or boilers are made with corrugations sufficiently deep to form flues running longitudinally along the boiler for the passage forwards of the flame and heated gases of the furnace, and between these flues channels for the circulation of the liquid under treatment. The boiling vessels may be arranged in the ordinary manner employed in the colonies. *Patent completed.*

2749. A. V. Newton. *Improvements in sewing machines.* (A communication.) Dated October 11, 1862.

This invention consists in providing the means whereby the use of the ordinary shuttle may be dispensed with, and the consequent necessity of rewinding the thread removed, while at the same time a regular shuttle stitch, alike upon both sides of the cloth, and of an elastic character, is produced. The invention further comprises a means for giving the requisite motions to the feed by the use of a spring cam feeding device, which is much stronger, and at the same time more simple and less liable to get out of repair than those in ordinary use. This invention cannot be described without reference to the drawings. *Patent completed.*

2750. S. Chatwood. *Improvements in, and connected with, fire and thief proof depositories, and locks or fasteners connected therewith, parts of which improvements are also applicable to other purposes of security.* Dated October 11, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2751. G. and A. Harvey. *Improvements in boring machinery.* Dated October 13, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2752. A. F. Gallis. *Covering street omnibuses and vehicles of every description for the purpose of sheltering passengers travelling on the top of the same.* Dated October 13, 1862.

In carrying out this invention, the iron rails are higher than usual, the actual height of them being still increased by a curtain which passes all round the omnibus. When bad weather comes on, the conductor requires only a few minutes to raise the cover, and a still shorter time to let it down, together with the upper rails, after the rain has ceased. Lateral openings in the cover serve to check the action of the wind. These openings can easily be closed and opened again by the passengers. The invention further consists in a mechanical contrivance by which a number of solid iron or other bars, contained within iron or other tubes, may, by means of chains, &c., worked over rollers with a handle within easy reach of the conductor, be raised to the proper height to support the covering or awning. The water-tight covering or awning lies folded up in fine weather behind the driver's seat. When required for use, the conductor simply draws a string attached to the cover, which then glides easily over the bars by means of rings or otherwise. When it is no longer required, the driver pulls it back by another string behind him. *Patent completed.*

2753. G. Haseltine. *Improvements in "jacks" and screw nuts for attaching thills and poles of waggons and other vehicles to the axletrees of the same.* (A communication.) Dated October 13, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2754. C. McCarthy. *Improvements in automatic safety valves.* Dated October 13, 1862.

This invention consists in the arrangement of a safety valve attached to a steam boiler, which will be acted upon by the water in the boiler, and will operate either when the pressure of the boiler becomes equal to or shall exceed the load on the valve, or will act in combination with a water indicator whenever the water in the boiler falls to a certain point below the fixed water-level in the boiler, the said valve being connected with the water in the boiler, and with the fire-place, so that in either case, and whenever the valve is raised, the water from the lower part of the boiler will be forced through the safety valve and thrown into the fire-place, so as to damp or extinguish the fire, and thereby prevent or remove all further danger. Whenever the improved "automatic" safety valve operates on account of an excess of pressure in the boiler, the water will be thrown into the fire-place upon the fire, so as to dampen the same, thereby diminishing the heat, and consequently the pressure in the boiler, when the valve closes again, and the fire will readily rekindle. When the valve operates in combination with the water-indicator on account of a deficiency of water in the boiler, the water will be thrown upon the fire as long as it continues to fall in the boiler, which will soon extinguish the fire altogether, preventing thereby any overheating of the fire-plates, and consequently avoid all further danger. The water-indicator, which operates the safety valve whenever the water in the boiler falls to a certain point below the fixed water-level, is so constructed as to operate independently of the safety valve as long as the water-level is above the fixed point, and acts then as an indicator to show the position of the water-level in the boiler; and only when the water falls below that point which may be considered dangerous the same will act upon the safety valve, so as to raise the same, and cause the water to be forced upon the fire to extinguish the same, and prevent thereby any further accident. *Patent completed.*

2755. W. Loeder. *An improved projectile to be used with ordnance or firearms of any calibre.* (A communication.) Dated October 13, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2756. C. Thomas. *Improvements in the manufacture of silicate of potash, and in the manufacture of artificial stone.* Dated October 13, 1862.

In the manufacture of silicates of soda, or of potash, it is usual to digest the silica with the potash or soda in a close boiler, in which mechanical stirrers have in some cases been arranged. According to this invention, the patentee mounts the boiler so that it can rotate or oscillate. The boiler is kept in motion during either the whole or a portion of the time occupied in the process of solution, and in this manner there is produced a friction between the several particles of silica sufficient to rub off the gelatinous coating formed by the action of the caustic alkali on the same, and thus the process of solution is greatly facilitated, clean or fresh surfaces being constantly presented to the action of the soda or potash. He prefers to use a jacketed boiler heated by steam rotating or oscillating horizontally. In manufacturing artificial stone, he combines a solution of silicate of soda with the refuse produced in the process of alkali making, and commonly known as "black ash waste," or with "burnt iron pyrites," ground or pulverized, or with a mixture of these two materials. The black ash waste and burnt iron ore will, when mixed either separately or conjointly with silicate solution, form a hard stony mass, and the composition whilst soft may be moulded into any desired form, or made into large or small blocks, suitable for building or other purposes. *Patent completed.*

2757. W. G. Haig. *A new article of apparel to be worn instead of, or in addition to, shirt front and waistcoat.* Dated October 13, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2758. J. Gumbley. *An improved break for vehicles travelling on common roads.* Dated October 13, 1862.

The object of this invention is the construction of apparatus in such manner that the power or pressure exerted by a horse (or other draught animal) in keeping back a vehicle in descending a hill or incline shall be so transferred or transmitted as to force a break on to or against the wheel. This may be effected as follows:—The breeching or other means on which the horse (or other draught animal) acts or presses to keep back the vehicle (when descending a hill or incline), instead of being attached to the shaft or pole, is attached to a chain or strap, or to chains or straps; such chain or strap, or each such chain or strap, runs round a pulley fixed on the under part of the shaft, or at the end of the pole, or in such like position, and thence passes to the end of a lever which works on a pin or axis at the oposite side of the vehicle; this pin or axis is fixed through the shaft, or in other convenient part, and the lever carries the break block, skid, or similar contrivance. When the horse applies pressure against the breeching or other means on which it acts for keeping back the vehicle, the levers will be thereby worked, and will bring the break-blocks, or other equivalent contrivances, into action. *Patent completed.*

2759. A. J. MAHON. *Improvements in propellers and paddle floats, also applicable to the raising and forcing of water or other fluids.* Dated October 13, 1862.

This invention relates to new forms of screws and screw-blades, and their combination and arrangement, so that the vacuum caused by the ordinary working and their different currents may be taken advantage of, and so that the centres of all screws may be made to work effectively, and get rid of centrifugal force and lateral loss. *Patent abandoned.*

2760. E. B. WILSON. *Improvements in apparatus employed in the manufacture of iron and steel.* Dated October 13, 1862.

This invention consists in the employment of a valve, stop-cock, or other suitable contrivance applied to the blast pipe or pipes of the atmospheric vessels, or of blast furnaces, employed in the manufacture of iron and steel, for the purposes of throttling or wire drawing the blast before entering such vessels or furnaces, and producing in reality a blow-pipe action, by reason of the tensity of the entering jet or jets of air, steam, or gas injected. *Patent completed.*

2761. S. SMITH. *Improvements in kettles, saucepans, and boilers for domestic and other purposes.* Dated October 14, 1862.

This invention consists in having a tube or tubes of suitable form from the bottom of the kettle, saucepan, or boiler, and terminating at the back, sides, or any part that is most suitable. The inventor likewise proposes making an arch from the bottom of the said kettles, saucepans, and boilers, starting from the bottom, and terminating at the back or sides, the object being to boil the water or liquid in detail. *Patent abandoned.*

2762. F. G. GRICE. *An improvement or improvements in the manufacture of nuts for screwed bolts, and in machinery to be employed in the said manufacture.* Dated October 14, 1862.

This invention consists in manufacturing nuts for screwed bolts at one heat, that is to say, by taking nut iron direct from the rolls and subjecting it without reheating to the treatment proper to convert it into nuts. By this invention the deterioration in the quality of the iron caused by reheating is prevented, and the nuts are produced of a uniform thickness. In carrying the invention into effect, the patentee rolls iron of the proper shape and size in suitably constructed rolls, and as the heated and shaped iron comes from the rolls he cut it into short lengths, by means of a circular saw, or by a pair of shears, the said lengths being of such a size as to enable the workman to hold them easily with a pair of tongs. He feeds these short lengths of nut iron into a machine working at a quick speed, cutting off the nuts from the nut iron, and shaping and punching the nuts while the iron retains sufficient heat for these purposes. The machine or machines which he employs for converting the nut iron into nuts have, essentially, the same construction and action as ordinary machines, but the parts are made to work with a quicker speed. *Patent completed.*

2763. E. LUCKOW and E. HABEL. *Certain improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials.* Dated October 14, 1862.

This invention relates to a novel description of machinery for twisting slivers or threads, or for doubling slivers or threads together, and simultaneously winding them upon bobbins; and the invention consists in a novel arrangement and adaptation of mechanism, which may be described as follows:—The sliver or single or doubled yarns pass from drawing rollers through a trumpet mouth, and thence through a guide or eye upon a sliding block, which delivers the yarn to the bobbin. This slide has a reciprocating traversing motion imparted to it by means of a right and left-handed screw, so as to distribute and lay the yarn evenly upon the bobbin; and in its traverse it acts upon a double-inclined plane, causing it to rise and fall in such a manner as to take up or compensate for the slack yarn which passes over it, and which arises from the different length of yarn between the ends and the middle of the bobbin. On the opposite side of the bobbin or fluted roller is placed, their peripheries being parallel, and kept in contact by means of annular springs pressing upon the bearings of the bobbin, which receives a rotary motion from the said rollers causing the winding on of the yarn. The speed of this fluted roller, and, consequently, the amount of twist in the yarn, is regulated and governed by a differential motion, which is effected by simple arrangements of bevel gearing or worm and worm-wheel, or other equivalent gearing driven from a continuous driving shaft provided for the purpose, and extending from end to end of the machine. This apparatus, excepting the differential motion, is arranged in a framework, in order to impart the twist to the yarn. The frame carrying the bobbin and fluted roller is caused to revolve between bearings by means of band and fast and loose pulleys attached to the frame, so that the bobbin is caused to revolve across its axis (end over end) as well as parallel thereto, by which means the twist and draw are effected simultaneously. *Patent abandoned.*

2764. H. BRIDSON and J. ALLCOCK. *Improvements in machinery for folding, measuring, and hooking woven fabrics.* Dated October 14, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2765. E. BARLOW, J. CLOUGH, and F. HAMILTON. *Certain improvements in machinery for driving cotton gins, and for preparing and combing cotton and other fibrous substances.* Dated October 14, 1862.

This invention consists in supporting the axles of the driving and fly-wheel shaft on anti-friction rollers, and in placing anti-friction rollers on each side of the said axles, by which means the friction, and, consequently, the power required for driving, are much reduced. Similar anti-friction rollers are or may be applied to the axles of the roller of cotton gins. The improvements in machinery for preparing cotton and other fibrous substances are applicable to slubbing frames, roving frames, and other machines of the like description, and consist in the application to such machines of additional wheels to the wheels now employed for transmitting the motion from the differential wheels to the spindles, by means whereof the irregularities in the taking up of the bobbins are prevented. The improvements in machinery for combing cotton and other fibrous substances is applicable to the circular combing machines, and consist in making the weight by which the sliver is held in the guide spout with two projections fitting in slots in the sides of the spout; these slots have each a shoulder or set off, so that, when the weight is in its place, it cannot be displaced by the extra depth of the sliver, or by the moving of the spout. *Patent completed.*

2766. J. SNIDER. *Improvements in the construction of "Hansom cabs" and other similar vehicles.* Dated October 14, 1862.

This invention consists in the application to the forward part of the top or front of the vehicle of a folding or moveable cape or curtain, sustained by a frame, and which can be projected or retracted at pleasure, and which is primarily destined to serve as a protection from the weather in lieu of the present inside folding glass or framed shutters or flaps, called "the glass," but also as a sun shade. *Patent completed.*

2767. C. HARRATT. *Improvements in ships' masts.* Dated October 14, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2768. D. and C. J. REID. *Improvements in the manufacture of cases for watches and other time-keepers.* Dated October 14, 1862.

This invention consists in the manufacture of cases for watches and other pocket time-keepers of the alloy or compound of copper and aluminium hereafter described:—The patentees believe that the best compound or alloy for the purpose consists of 92½ parts of the best copper, and 7½ parts of aluminium; this alloy possesses a good gold colour, and has good working qualities. The proportions of the alloy may, however, be somewhat varied. *Patent completed.*

2769. M. CARTWRIGHT. *Improvements in plates for artificial teeth.* Dated October 14, 1862.

This invention consists in combining leaf gold, or finely precipitated gold with india rubber or gutta percha, for the purpose of forming plates for artificial teeth. The patentee first dissolves the india rubber or gutta percha, and grinds the gold leaf with the same, in order effectually to combine the metal with the gum used. He afterwards heats this compound to render it plastic, and shapes the plate by working it over or into a mould or model of the plate to be produced. The invention further consists in forming plates of a combination of sulphuret of zinc and kaolin, which, after being reduced to a liquid state, is applied in successive layers upon the model of the plate to be produced, until a sufficiently thick plate composed of such layers is formed. In some cases, for affording additional strength to the plates, he introduces some fibrous material or metal gauze. *Patent completed.*

2770. R. A. BROOMAN. *Improvements in apparatus for carburetting gas.* (A communication.) Dated October 14, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2771. R. A. BROOMAN. *Imprvements in dressing millstones, and in materials employed therein.* (A communication.) Dated October 14, 1862.

This invention consists, essentially, in dressing millstones by the action of hydro-fluoric acid on the silicious matter of which the stones are more or less composed. *Patent abandoned.*

2772. E. H. C. MONCKTON. *Improvements in coils of inductions, and in obtaining and applying power by means of electro-magnetism.* Dated October 14, 1862.

We cannot here quote the voluminous details of this invention. *Patent completed.*

2773. O. J. and J. SHOWELL. *Improvements in the construction of glass roofs and roof lights.* Dated October 14, 1862.

This invention relates to a mode of constructing glass roofs or roof lights in such a manner as to render them water-tight, without the use of putty or cement, and so that they may be capable of giving way to slight movements arising from expansion and contraction, and from other causes; and the invention consists in the use of glass sheets or plates, with their two opposite parallel edges turned at right-angles or thereabouts to the plane of the sheet or plate, and in arranging such sheets or plates so that their turned edges will come together, the edges being placed either up or down; if upwards, they are covered with a cap; if placed downwards, they enter a gutter, the caps or gutters being made of metal or other suitable material. *Patent completed.*

2774. S. HEALEY. *Improvements in the manufacture of zinc.* Dated October 14, 1862.

This invention consists in constructing the furnaces employed in the melting and annealing of zinc in close proximity to each other, so that the process of annealing may be effected by means of the waste heat escaping from the melting furnace. *Patent abandoned.*

2775. J. H. JOHNSON. *Improvements in sewing machines.* (A communication.) Dated October 14, 1862.

This invention relates to a peculiar construction and arrangement of sewing machine suitable for button hole, or edge-finishing, or stitching. In this machine the vertical needle bar or carrier has a lateral motion imparted to it by a cam, for the purpose of causing the vertical needle to pass alternately through and over the edge of the material operated upon. The up and down motion of the needle bar is obtained from a crank pin in a disc on the front end of a driving shaft working in a slotted piece attached to the needle bar. The cam shaft is placed vertically, and receives its motion from the driving shaft by means of a bevel wheel and pinion, it making one revolution for two of the same shaft. A loop carrier operates beneath the table, being connected by a bar with a suitable cam on the vertical main shaft. The detailed arrangements as described in the specification are very voluminous, and cannot be given here in full. *Patent completed.*

2776. E. MOLYNEUX. *An improved carriage with a travelling railway attached.* Dated October 16, 1862.

This invention consists essentially in the construction of a carriage so related to and connected with two short lines of rails, that it shall change from one to the other by the revolution of its wheels, without the rails being required to move either laterally, diagonally, or vertically, and that a portion of its moving force shall be employed to shift successively each line of rails as it becomes free, to a position on the ground over which the carriage will have to travel immediately on leaving the rails on which it is bearing, and so to form a continuous travelling railway of two short and independent lines of rails. *Patent completed.*

2777. W. WILSON. *An improved oblong drawing-room, bagatelle, and billiard table with reversible top, and made in various shapes and sizes.* Dated October 15, 1862.

This invention consists of an oblong drawing-room, bagatelle, and billiard table, so constructed that the game is on one side, and by reversing the top it forms a drawing-room table, made oblong, oval, circular, and other shapes, and in various sizes. The peculiarity of this invention is the compactness of the table, that side on which the game is played being concealed in the frame when shut, and the top has only to be turned over when the game is required to be played. That side of the table on which the game is played has a channel or rim on both sides, or may be with a groove, bridge, or tunnel enclosed. *Patent compteled.*

2778. J. H. JENKINSON. *Certain improvements in drinking fountains.* Dated October 15, 1862.

This invention consists in applying to drinking fountains tubes through which water is drawn into the mouth of the drinker by suction. *Patent completed.*

2779. J. TAYLOR. *Improvements in temples for looms.* Dated October 15, 1862.

In carrying out this invention the patentee gives to and fro motion to revolving combs working loosely at one end in an concentric slot, and at the other end in an eccentric slot, both of which slots are held stationary in the temple head. As the combs or teeth revolve they project one after the other beyood the periphery of the roller which contains them, and thus catch the fabric as it is woven, and keep it extended to its proper width, and where necessary, as in woven fabrics, give it an extra stretch in the transverse direction. Each set of combs or teeth holds the fabric in its extended position until the succeeding set takes hold, and all the combs recede one after the other in the grooves of the roller which contains them. *Patent completed.*

2780. C. DE BERGUE. *Improvements in the apparatus for the crushing and treatment of ores.* Dated October 15, 1862.

Provisional protection has not been granted for this invention.

2781. C. DE BERGUE. *Improvements in the permanent way of railways.* Dated October 15, 1862.

This invention has more especial reference to further improvements upon a certain description or descriptions of permanent way, and of certain parts thereof, in respect of which letters patent were granted in 1853 (No. 1245), and in 1861 (No. 2616), namely, the permanent way or ways in which the rails rest upon and are held in cast-iron chairs or cast-iron sleepers, without upright bags or jaws, but are secured to each such chair or sleeper by a clip piece, and by one bolt or fastening only. Now whereas in such permanent way or ways the arrangements have been such as to accommodate flat-bottomed rails, he now proposes to accommodate double-headed rails. The present improvements consist—1, In forming the chair or the sleeper with seating for the rail of a form corresponding with the section of the double-headed rail, or nearly so, but, as above stated, without the common upright lugs or jaws, such seating providing a lateral abutment for the inner side of the lower head or member of the rail. 2, In forming the clip piece so that it shall not only press upon the upper side of the lower head or member of the rail to prevent the rail rising or jumping, but shall also present an abutment or resistance against which the web of the rail shall bear to maintain the rail in the intended upright or nearly upright position, and so prevent its tilting or tumbling over the tail of the clip piece itself; also taking a lateral abutment against the chair or sleeper. And, 3, The use of the foregoing in combination with a double-headed rail and a single bolt with each clip piece to form permanent way. *Potent completed.*

2782. W. POPE. *Improvements in coating the sides of ships, batteries, forts, or other places with defensive armour plates.* Dated October 15, 1862.

The patentee claims applying to the hulls of ships, floating batteries, or land forts, plates, sheets, or shelves of metal and timber combined, or of metal and any other substance combined, in such wise that one edge of such plates of metal, or metal and timber, or metal and any other substance, shall be outermost to receive the shock of the shot, shell, or other projectile. *Patent completed.*

2783. P. Potenza. *The extraction, preparation, and spinning of the silky fibre contained in the bark of mulberry trees, and the manufacture of the same into textile fabrics.* Dated October 15, 1862.

This invention is carried out as follows:—The bark, after careful separation from the wood, is subjected to a process of thorough desiccation, which process should take place very gradually, by preference in the open air, and under very moderate action of the sun, as otherwise the bark would not form the so-colled "maca," and the fibrous substance which it is desired to extract would be totally destroyed. When the bark has been thoroughly dried, the fibrous substance which will then be found in the same in the form of agglomerated filaments of an exceedingly fine texture, is carefully extracted by separating from it all extraneous matter that will be found adhering to it, such as the epidermis, the green bark or rind resembling a skin, and the liber, whenever this is found next the sap (as it is not always there). This separation of the silky fibre from the various layers of bark, and from all other substances by which they are held cemented together, to a certain extent, is effected most readily by boiling the bark either in water alone, or with the admixture, by preference, of a mineral acid, or of a vegetable alkali, combined with the base of an oil or fat; or the patentee sometimes employs a mineral alkali, or even vegetable acid, for this purpose. By this means the masses of fibres or filaments are not only freed from all extraneous matters and impurities, but are rendered exceedingly soft, and capable of being separated from each other in the most perfect manner. The fibres are finally opened out, carded, formed into slivers, and the doubling and stretching effected by ordinary machinery. *Patent completed.*

2784. J. B. G. M. F. Piret. *Improvements in lubricating apparatus.* Dated October 15, 1862.

This invention relates to an improved oil box, or that of any other liquid or lubricating apparatus for lubricating all kinds of axles, and especially railway carriage axles, the characteristics of which are—1. A continual rise and spread of the liquid obtained from a lower reservoir over the surface of the axle. 2. A partition placed at the lower part of the axle box, which prevents any escape of the liquid at back of the reservoir, caused by the motion of the vehicle. 3. An improved coupling or stuffing box, fixed behind the journal, which prevents all lateral spread of the liquid from the box along the axle. 4. The application of a guard plate for preventing the introduction of any foreign matter into the box. The invention cannot be described without reference to the drawings. *Patent completed.*

2785. F. F. Prud'homme. *Improvements in machinery or apparatus for raising water.* Dated October 15, 1862.

This invention consists of two main portions, one of which the patentee calls the lift pump, and the other the driving or force pump. The lift pump is placed nearly at the bottom of the well, shaft, or other place whence water is to be lifted. The force or driving pump is outside such well, shaft, or place, and close to the steam or other driving engine or motive power employed, whatever be the distance of such engine or power from the mouth of the said well, shaft, or place. The two portions, that is, the lift pump pump and the driving or force pump, communicate by means of one or two strong and staunch pipes, through which the water rises, such pipe or pipes opening at bottom into the lift pump, and at their further end into the driving pump. The lift pump is a cylinder or barrel, closed at the ends, and fitted with two equal solid pistons on the same rod. This cylinder or barrel is divided endwise by a solid partition or diaphragm, through which the rod of the pistons passes, the rod working through a stuffing box. Suction and force pumps are provided. The force or driving pump consists of a cylinder or barrel fitted with a solid piston worked by a steam or other engine or motive power, and the to-and-fro motion of this piston is transmitted to the pistons in the lift pump by the water in the ascension pipes. The force pump piston is connected to the steam or motive engine by jointing the pump piston rod to the crank arm or beam of such steam or motive engine. The lift and force pump cylinders are bored and formed smooth and true on the inside. The lift pumps may most conveniently be fitted three or four yards above the surface of the water to be raised. *Patent completed.*

2786. J. Bapty. *Improvements in apparatus for preparing wool and other fibrous materials.* Dated October 15, 1862.

For the purposes of this invention a conical drum is used mounted on axes; and on the surface of this drum are teeth, which are, by preference, set in spiral lines. The drum revolves within a case, and there is a rocking bar (or bars) applied from end to end of the case. On this bar or bars there are teeth which, on the rotation of the conical drum, come between the teeth on the drum. The bar or bars have a rocking motion applied thereto, so that the teeth thereon are moved or swung to and fro. At the under part of the case of the drum is a chamber to which a fan or exhausting apparatus is applied, so as to produce a slight current from the chamber towards the fan, sufficient to remove the dust as it passes through a partition which is placed between the exhauster chamber and the chamber within which the conical drum revolves. This partition is made with bars, or is otherwise made reticulate, so as to admit of the dust passing through, whilst the fibrous matters which are being acted on are prevented passing through the partition. The fibrous matters which are to be opened out or mixed, and thus prepared for the subsequent process of carding or otherwise, are fed in at the side of the case of the machine near the smaller end of the conical drum, the feed extending along only a portion of the length of the conical drum. As the fibrous substances are more and more thrown and beaten in the machine, they will progressively be moved from the smaller end towards and out of that end of the case where the larger end of the drum is situated, which is open for the purpose of permitting the fibres as they come to the larger end of the drum to be thrown off therefrom through the open end of the case. *Patent abandoned.*

2787. R. A. Brooman. *Improvements in felting machines applicable also to the fulling, scouring, and dressing of pure and mixed woollen stuffs.* (A communication.) Dated October 15, 1862.

These machines are intended specially for the production of felted threads, but they apply also to the fulling, felting, scouring, and dressing with heat and moisture of pure or mixed woollen stuffs. In the machine two frames carry the felting rollers arranged in two series, one series revolving above and between the other series. Alternate rectilinear motions are simultaneously imparted to both frames, while an endless apron and the rollers are made to rotate. The machine is composed of a frame carrying bearings for supporting a main shaft, upon which four eccentrics are fitted which turn in collars, and rods from these collars are jointed to two frames; these frames carry the felting rollers, and are supported upon rods which are free to slide to and fro in bearings on the frame of the machine. Rotary motion is communicated through a bell to pulleys on the main shaft, whereby the eccentrics impart rectilinear to-and-fro motions to the frames, and, consequently, to the two series of rollers carried by them. An endless apron is carried over the under rollers between them and the upper rollers and round stretching rollers. The felting rollers may be clothed to facilitate adhesion of the threads being felted. The apron is driven by ratchet and bevel toothed-gear, and its speed of rotation may be increased or diminished as desired. Spaces are formed between the fronts of the two frames for the entrance of the threads which, coming from cans or bobbins, pass between the apron and upper rollers, and issue through another space in the back of the frame to be wound on a reel. As it is necessary that no very great pressure should be exerted upon the threads, in order to their being round and even, and as only slight friction is requisite, the upper rollers revolve in open topped bearings; and this arrangement facilitates their removal when necessary for passing the apron over the lower series of rollers. When required to impart a differential movement to the rollers, the inventor gears them by toothed-gear and endless chains calculated to produce the speeds required. To assist the felting a steam jet, as generally used, is introduced in the ordinary manner. The apron and the upper series of rollers may be covered with sponge to impart thereto a certain degree of elasticity favourable to the operation of felting. *Patent completed.*

2788. R. A. Brooman. *Improvements in refrigerating and freezing, and in apparatus employed therein.* (A communication.) Dated October 15, 1862.

This invention consists in cooling or freezing in vacuo by the abstraction of heat owing to the evaporation of a volatile liquid, such as bi-sulphide of carbon, ether, or other volatile liquid, contained in a space surrounding the the vessel in which the substance to be cooled or frozen is placed, as well as by condensation of the vapour arising from the substance cooling or freezing, and this in an apparatus constructed and working substantially as described with reference to the drawings. *Patent completed.*

2789. E. A. Cowper. *Improvements in steam engines.* Dated October 15, 1862.

The present improvements have for their object the maintaining more uniformly the temperature of the steam during its action on the pistons; and the invention consists in constructing for this purpose a steam-jacketed reservoir of the following arrangement:—The patentee constructs a steam-jacketed reservoir, having a lining of metal inside it, placed at a small distance from the sides, which lining has a large opening in it, through which the steam enters into the central space without coming into very extensive contact with the steam-jacketed sides of the reservoir, whereas, on the contrary, when the steam is withdrawn from the reservoir, it is caused to pass through a hole or holes in the lining at one part, and to pass between the lining and the steam-jacketed sides of the reservoir for some distance before it leaves it, so that as far as possible it should be maintained at the temperature at which it left the boiler. Or the reservoir is made of any other form composed of cylinders, tubes, or plates, with a space or capacity for the steam to enter it freely without coming into extensive contact with the steam-jacketed parts, and then is so arranged that the steam on leaving does come into contact with such parts, so that as far as possible it should be maintained at the temperature at which it left the boiler. This mode of constructing a reservoir with a space or capacity into which the steam may enter freely from the first working cylinder, whilst means are provided for maintaining it as far as possible at the temperature at which it left the boiler as it leave; such reservoir, is applicable to engines in which either natural or superheated steam is used. *Patent completed.*

2790. W. Barningham. *Improvements in the permanent way of railways.* Dated October 16, 1862.

This invention consists in making railway sleepers, when either transverse or longitudinal, of wrought iron rolled to a semi-elliptical or other suitable form, to combine strength with lightness, and of sufficient area to be firmly supported in the ballast. The rails are attached by bolts or otherwise to chairs or half-chairs, which are welded, riveted, or bolted to the sleepers; or the chairs may be formed of strips of metal cut from the top of the sleeper on three sides, and bent into the required form to suit the shape of rail. When bridge or other flat-bottomed rails are employed they may bear upon and be connected to the sleepers by bolts or rivets. *Patent completed.*

2791. G. Berry. *Improvements in locks.* Dated October 16, 1862.

This invention comprises improvements in that description of lock in which a number of sliding guards pass through notches in a locking plate also having notches in it. In ordinary locks of this description these sliding guards move in grooves by the direct action of a key or instrument, and there is no impediment to an instrument or picklock being inserted in these grooves in such a manner that an operator is able to detect in what part of each sliding guard the notch belonging to that particular guard is placed. The first improvement consists in cutting notches in the sliding guards at right angles to the notches which have to pass the locking plate. He then places an immoveable mask or partition in each of the first named notches, and these masks or partitions consist of rings placed in a barrel; or a plain plate placed in a box, when the motion intended to open the lock is lineal, instead of circular. The result of this arrangement is that the notches in the guards cannot be got at by any instrument whatever, as they are placed in a line parallel to the part acted upon by the key, but separated by masks or partitions. The second improvement consist in cutting the sliding guards into two parts, in such a manner that, if force be applied to one part, that force will be communicated to the other, and both will move in the same direction. These parts through which force and motion are communicated to the other parts are called media. The result is that no vibration of such parts which indirectly receive force and motion is communicated to any picklock or instrument applied to open the lock, whereas in ordinary locks of this description vibrations occur in the sliding guards which distinctly convey to an expert attempting to pick the lock the precise position of the notch where the sliding guard is placed, and by repeating this operation upon each guard he will be enabled to make a key which will open the lock. *Patent abandoned.*

2792. G. T. H. Pattison. *Improvements in machinery or apparatus for embossing or finishing woven fabrics.* Dated October 16, 1862.

The patentee claims obtaining an improved diagonal silk finish upon woven fabrics by using an embossing roller of a single thickness, or with a shell or surface of iron or steel. *Patent completed.*

2793. G. T. H. Pattison. *The imparting of an improved surface or appearance to fabrics woven with mixed materials.* Dated October 16, 1862.

The patentee claims producing a new and improved surface, appearance, or finish upon woven fabrics, by subjecting mixed fabrics woven with cotton warps and worsted weft to a "slash" engraved roller, the impression due to which is retained only or chiefly by the cotton, as described. *Patent completed.*

2794. H. A. Remiere. *An improved horse collar.* Dated October 16, 1862.

This invention consists in replacing the ordinary materials used for stuffing horse collars, such as hay, straw, and curled hair, by two or more cushions or pads of prepared india rubber, filled with air, and so constructed that the india rubber of which the cushions are made is not distended, nor the air with which they are filled in so compressed a state as in those of the air collars at present known. The advantage of this is, that the air is not liable to escape, and the collar retains its form and firmness, yielding only sufficiently to make it comfortable for the horse to pull against. *Patent completed.*

2795. F. Delmas. *A rain absorber.* Dated October 16, 1862.

This invention consists of a band formed of sponges, and is intended to prevent the rain running down from hats, caps, umbrellas, and other articles round which it is placed, and to protect the bearer or persons near him from water pouring down therefrom. The dripping rain is completely absorbed by the sponges of which the absorber is formed. *Patent abandoned.*

2796. T. G. Harold. *Improvements in locks.* Dated October 16, 1862.

The shell containing these improvements, when in the form of a padlock, is secured together by means of flanges formed on each of the side plates of the said case, and the said flanges have screws cut thereon, so that one will screw into the other; the shackle passing through these flanges prevents the lock from being taken apart when locked. To hold the shackle or bolt when locked, the inventor employs circular tumblers, with flanges turned up or formed around the edges, and the said flanges should be provided with teeth or decoy notches on the inner side, and a slot through each flange, so that a shackle or bolt provided with the proper projections will be retained by the flanged tumblers, and the said projections taking into the decoy notches in the flanges of the tumblers, to prevent any person from finding out the position of the slots in the flanges that pass the projections of the shackle or bolt in unlocking. These flanged tumblers are placed one inside of the other, and are connected by solid and pipe-shaped arbors to dials or pointers on the outside of the lock plates, and by setting these dials or pointers to the proper positions, the slots in the tumblers will all be in a line, so that the shackle or bolt will pass outside. The change of combination is effected by placing the flanged tumblers in a different position to the dials or pointers. *Patent abandoned.*

2797. E. Humphrys. *Improvements in steering apparatus.* Dated October 16, 1862.

This invention consists in so combining apparatus for acting by hydraulic power on the rudder of a ship or vessel, that the hydraulic cylinder and other apparatus intermediate of it and the rudder may be all below the line of floatation, and, consequently, out of the way of shot. For this purpose, an arm or projection is fixed to the rudder sufficiently below the water line to protect it from shot. This arm is suitably connected to the piston-rod of the hydraulic cylinder, which is also situated below the water line of the ship or vessel. A stuffing-box is formed through the stern of the ship or vessel for the passage of the piston-rod, or of a connecting rod, so that the communication between the piston of the hydraulic cylinder and the rudder may be water-tight. The arrangement for working the hydraulic pumps and apparatus may be according to the means at present in practice, or otherwise. *Patent completed.*

2798. H. Ransford. *Improvements in building ships and other vessels.* Dated October 16, 1862.

This invention has for its object improvements in the formation of ships, boats, and other vessels, specially with reference to that part between the extreme beam and the stem known as the bows of a ship. For these purposes, in building a ship or vessel, the actual floor and bottom of the ship or vessel is to be constructed wider at the extreme beam, and so as to extend as far or farther forward, and laterally, than the horizontal section taken at the water line when loaded. It is preferred that the floor should extend as near the stem or most forward part of the bow as practicable. The peculiarity of the invention consists in carrying the floor of a ship or vessel, whether flat or with more or less dead rise laterally beyond a perpendicular dropped from the outside of the timbers at the water line, so that the ribs or side timbers slope upwards and inwards from the floor timbers to the deep-load water line, or beyond, as advisable. A ship may advantageously be constructed on this principle even one-fourth or more wider at the floor or bottom than at the deep-load water line at the extreme beam, but whatever slope or angle is adopted at that part it should be diminished. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Dec. 20, 1862.

3410. W. Perkins, Churchfield House, Margate, Kent, consulting chemist. Improvements in the manufacture of a substitute for turpentine, which is also applicable to the manufacture of varnishes, and to purposes to which turpentine is now ordinarily applied.

Dated Jan. 24, 1863.

218. E. Shackleton, Loth, near Ruysbrook, Belgium, overlooker. Improvements in looms for weaving.

Dated March 14, 1863.

697. W. Young, 77, Fleet-street. Improvements in type composing and distributing machines.

Dated March 20, 1863.

742. W. Reay, jun., Thropton-hill, near Rothbury, Northumberland, mining engineer. An improved machine for amalgamating minerals and other metalliferous and metallurgical products or substances.

Dated March 26, 1863.

789. G. Cowdery, Llanmynech, Salop, civil engineer. Improvements in machinery for making bricks.

791. N. R. Hall, Rosherville, Northfleet, Kent. Improvements in construction of weighing apparatus.

793. T. Parkinson, salesman, and J. Wood, embroiderer, Manchester. An improved application of embroidery to cotton printed fabrics.

795. G. Davies, No. 1, Serle-street, Lincoln's-inn, civil engineer. Improvements in engraving upon metals. (A communication.)

797. J. Norton, Bray, Wicklow, Ireland, Esquire. Improvements in projectiles or ignition missiles.

799. F. Applegate, Bradford-on-Avon, Wilts, woollen manufacturer. Improvements in railway carriage doors.

Dated March 27, 1863.

801. J. Grantham, 31, Nicholas-lane, civil engineer. Improvements in apparatus connected with machinery used in manufacturing compressed fuel.

803. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in machinery for scouring wool. (A communication.)

Dated March 28, 1863.

809. A. H. Perry, Guildford-road, Brighton, railway inspector. Improvements in working railway points, switches, and signals, and in the apparatus to be employed for that purpose.

811. J. Leeming and R. S. Markindale, worsted spinners, Broughton, Lancaster. An improvement in carding engines.

813. W. Symons, Hatton-garden, philosophical instrument maker. Improvements in barometers.

815. J. Dale, Manchester, manufacturing chemist, and G. Bischof, jun., Swansea, Glamorgan, chemist. Improvements in the manufacture of aniline, napthylamine, and other analogous bodies, and in apparatus connected therewith, which apparatus is also applicable to obtaining finely divided metallic iron for other purposes.

Dated March 30, 1863.

819. H. Hughes, Homerton, Middlesex, engineer. Improvements in machinery for shaping metal and plastic substances.

821. W. E. Newton, 66, Chancery-lane, civil engineer. An improved process for producing yellow colouring matters, and other colours which may be derived therefrom. (A communication.)

823. J. Payne, Kircudbright, ironmonger. Improvements in fire-escapes.

Dated March 5, 1863.

825. J. Smethurst, Royton, Lancaster, coal proprietor and millowner. Improvements in steam engines and boilers, art of which improvements is applicable to heating purposes.

827. R. Furnival, Manchester, machine and tool maker. Improvements in and applicable to platting or braiding machines.

829. A. H. Bell, Dover, Lieutenant, R.A., and V. G. Bell, Woburn-place, civil engineer. An improved mode of constructing the armour of vessels of war.

831. E. O. Coe, Brook-street, Grosvenor-square. Improvements in propellers for ships and other vessels.

833. J. M. Dunlop, Manchester, engineer. Improvements in machinery for ginning cotton.

Dated April 1, 1863.

834. J. S. Grimshaw, Huncoat, near Accrington, Lancaster, spinner and manufacturer. Improvements in carding engines.

835. J. Hindle, Sabden, calico printer, W. F. Calvert, Enfield, cotton spinner, and E. Thornton, Padiham, manager. Improvements in looms for weaving.

837. J. Bray, Stretford, Lancaster, plumber, painter, and glazier. Improvements in the construction of omnibuses, railway carriages, and other vehicles.

838. M. Henry, 84, Fleet-street, patent agent. An improved method of lubricating. (A communication.)

840. W. West, Euston-road, civil engineer. Improvements in working railway signals.

841. W. Mitchell, Carlton-hill East, St. John's-wood, gentleman. An improved process for coating iron. (A communication.)

843. E. B. Wilson, 5, Parliament-street, Westminster, engineer. Improvements in the manufacture of iron and steel and other metals, and in the apparatus employed therein.

Dated April 2, 1863.

847. E. F. Clarke, Holmer-road, Widemarsh, Holmer, Hereford. Improvements in the means of fastening rails for railways.

849. J. Cassell, La Belle Sauvage-yard, publisher. Improvements in stills for the distillation of petroleum and other heavy oils.

851. W. Jones, Liverpool, boiler maker and iron shipbuilder. Improvements in the construction of ships or vessels, part of which improvements are also applicable for constructing buildings, and for various other purposes in which rolled iron is employed.

Dated April 4, 1863.

854. A. Stewart, Helensburgh, Dumbarton, saddler. Improvements in saddles.

856. J. Blain, Manchester, commercial traveller. Improvements in the finish of threads and yarns.

857. P. Hanrez, engineer, Marchiennes au Pont, Belgium. Improved machinery or apparatus for drying coal, grain, and other substances.

859. W. H. Perkin, Seymour-villa, Sudbury, Middlesex. Improvements in the manufacture of red and orange colouring matters.

861. J. Gimson, Leicester, engineer. Improvements in the means of actuating shuttles in looms for weaving narrow fabrics.

863. P. Spence, Newton-heath, near Manchester, manufacturing chemist. Improvements in the manufacture of sulphuric acid and sulphate of iron.

Dated April 6, 1863.

865. B. Cooper, Frome, Somerset, manufacturer. Improved apparatus for feeding scribbling or carding engines.

869. J. Railton, iron founder, and H. Booth, manager, Blackburn, Lancaster. Improvements in machinery for carding cotton and other fibrous substances.

Dated April 7, 1863.

873. H. Gilbee, No. 4, South-street, Finsbury. A new composition for dressing and preparing silk, cotton, and woollen tissues and fibres, and also mixtures of the same. (A communication.)

877. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in polishing precious and other hard stones, and in the machinery or apparatus employed therein. (A communication.)

879. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in reproducing or obtaining facsimiles of the veins, pores, knots, and figures of wood upon paper and other surfaces. (A communication.)

881. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improvements in projectiles for ordnance, and in fuses therefor. (A communication.)

Dated April 8, 1863.

883. W. Simpson, Liverpool, gentleman. Improvements in insulating the magnetic needle or needles in compasses.

885. J. N. Brown, Handsworth, Stafford, gentleman. Improvements in securing or connecting the bearing springs of railway carriages and waggons to the axle boxes of the said carriages and waggons.

886. T. Gray, Lower Mitcham, Surrey, bleacher. Improvements in preparing and bleaching jute and other vegetable fibres for spinning and other purposes.

887. J. R. Harris, Hawley-road, Kentish-town, house decorator. Improvements in propelling vessels.

889. W. H. Mitchell, Hampstead, gentleman. An improved construction of barometer.

891. A. Kinder, 20, Cannon-street, engineer. Improvements in coating or covering lead or alloys of lead with tin or alloys of tin, and in the apparatus employed therein.

Dated April 9, 1863.

893. D. J. Cooke, Manchester, dyer and finisher. Improved compounds or compositions for sizing, stiffening, and colouring yarns and textile fabrics.

894. T. T. Heath, Liverpool, artist. The application of glass for ceilings and the like overhead parts of houses and other structures.

897. A. Hett, London, Doctor of Medicine, and F. W. Basset, Camberwell. Improvements in preventing the fouling of ships' bottoms, and in cleansing the same when fouled.

899. R. K. Penson, Ferryside, Carmarthenshire. Improvements in apparatus used for warming railway carriages. (A communication.)

903. G. Low, Newark-on-Trent, Nottingham, engineer. Improved machinery for boring rocks and other hard substances.

Dated April 10, 1863.

905. G. Colomb, Aigle, Vaud, Switzerland, civil engineer. A process of manufacturing factitious blocks of wood of diversified shades and hues proper for veneering and other purposes.

907. T. Baldwin, Bury, Lancaster, engineer. Improvements in superheating steam, and in apparatus connected therewith.

909. H. R. Spicer, 3, Clement's-lane, Lombard-street, ship broker. Improvements in boxes or cases for the enclosure and preservation of human remains.

910. R. Smith, 10, Southampton-terrace, Crompton-road, Islington, gentleman. An improved medicated oil for the preservation of metal, wood, or stone.

911. J. Wightman and C. Dening, Chard, Somerset, agricultural implement makers. Improvements in horse rakes.

913. H. W. Ripley, Montpellier-lawn, Cheltenham. Improvements in machinery for preparing and printing wool and other fibres. (A communication.)

Dated April 11, 1863.

915. F. Versmann, 7, Bury-court, St. Mary Axe, consulting and analytical chemist. Improvements in moulding machines.

917. D. Mylrea, Church, near Accrington, Lancaster, millright and engineer. Improvements in fire-bars or furnace grids.

919. J. Farrar, Halifax, machine maker. Improvements in machinery or apparatus for twisting and doubling yarns of wool or other fibrous substances.

921. P. P. Baly, 4, Robert-street, Adelphi, civil engineer. Improvements in constructing breakwaters, piers, sea walls, and other similar structures.

923. C. A. Collins, Trowbridge, Wilts, gentleman. An improved method and apparatus for loading carts and waggons with hay, straw, and other similar products.

Dated April 13, 1863.

925. J. Gill, Mid Lothian, Edinburgh. Improvements in printing machinery.

927. R. Leggett, engineer, and R. Gittus, farmer, Mildenhall, Suffolk. Improvements in the construction of machinery or apparatus for cutting chaff and other agricultural produce.

928. J. Lark, White Lion-wharf, Bankside, Southwark. Improvements in the manufacture of artificial fuel and cement.

929. R. Reeves, Bratton, Wilts. Improvements in the manufacture of liquid manure drills.

931. M. Myers, Wigmore-street, Cavendish-square. Improvements in the construction of trunks, portmanteaus, and boxes.

Dated April 14, 1863.

933. J. Nasmyth, foreman, and S. Thornton, Manchester, mechanical draughtsman. Improvements in machinery for carding cotton and other fibrous substances.

935. G. T. Smith, Horsdall-house, East Retford, Nottingham. Improvements in metallic window shutters.

937. J. Combe, engineer, and J. H. Smalpage, woollen draper and tailor, Leeds. Improvements in the action and arrangement of machines for winding cops; in the construction and arrangement of banks for holding cops for warping purposes; in the formation of shuttles for receiving cops; and for apparatus for packing and securing cops in shuttles—one part of which improvements, consisting of a spring clutch, is applicable to machines in general.

939. H. Trapnell, Bristol, mahogany merchant. Improvements in vent pegs.

941. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in lamps for burning light and heavy mineral and vegetable oils. (A communication.)

Dated April 15, 1863.

943. J. Leach, Cheadle, Chester, commercial clerk. An improved machine or apparatus for washing, squeezing, mangling, and churning.

947. H. A. Bonneville, 24, Rue du Mont Thabor, Paris, patent agent. Improvements in the construction of gas burners. (A communication.)

949. W. Spence, 50, Chancery-lane, patent agent. Improvements in the manufacture of gunpowder. (A communication.)

951. J. S. Morton, Northampton, cabinet maker. Improvements in locks.

952. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. An improved construction of blowing apparatus. (A communication.)

953. T. B. E. Fletcher, Birmingham, doctor of medicine. Improvements in apparatus for collecting the solid portions of sewage.

Dated April 17, 1863.

964. S. Riley, Oldham, Lancashire, agent. Improvements in the manufacture or preparation of cocoa and chocolate.

Dated April 18, 1863.

972. C. W. Siemens, 3, Great George-street, Westminster, and F. Siemens, Birmingham. Improvements in furnaces which are principally applicable to the smelting of iron.

974. T. A. Weston, Birmingham, mechanical engineer. Improvements in ratchet levers.

976. G. A. Buchholz, Montague-place, Clapham-road, engineer. Improvements in apparatus for hulling grain, and for reducing granular substances.

Dated April 20, 1863.

980. G., W., and J. Graham, Burnley, Lancaster, machine makers. Improvements in machinery for folding, or plaiting fabrics.

982. J. Robey, Newcastle-under-Lyme. Improvements in apparatus for separating fluids from more solid matters mixed or combined therewith.

Dated April 21, 1863.

988. E. L. Simpson, Bridgeport, Fairfield. An improvement in waterproof compounds, and in fabrics prepared therewith.

990. M. Runkel, Centre-street, New York, engineer. Improvements in marine steam-engine governors. (A communication.)

994. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in wrenches. (A communication.)

996. W. Campion and G. Wilson, Market-place, near Sneinton, Nottingham, general mechanists. Improvements in machinery or apparatus employed in the manufacture of looped fabrics.

Dated April 22, 1863.

998. F. E. Byrant, Alfred-street, Bedford-square, gentleman. Improved apparatus for ascertaining the temperature of steam and its power of tension. (A communication.)

1000. F. Durand, Paris, mechanical engineer. Improvements in moulding articles of china or other clay or of other plastic materials.

Dated April 23, 1863.

1008. J. Whitley, J. B. Pope, and J. W. Burton, Leeds. Improvements in the manufacture of metals.

1010. W. E. Newton, 66, Chancery-lane, civil engineer. An improved mode of repairing worn-out files and rendering them again fit for use. (A communication.)

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated April 24, 1863.

1020. R. Lavender, 332, Goswell-road, Islington, ink manufacturer. A new compound to be used as a lubricator.

Dated April 28, 1863.

1065. G. W. Fuller, Cambridge-port, Middlesex. A new and useful or improved submarine lantern to be used in explorations beneath the surface of the ocean or any other large body of water.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, May 5, 1863.

3409. J. Platt and W. Richardson. Scutchers or beaters of cotton machinery.

3421. C. Pieper. Governor.

3424. C. A. F. Collette. Lace.

3429. S. Russell. Stereoscopes.

3434. F. N. Gisborne. Indicating the speed of ships at sea.

3444. J. Taylor. Carding.

3445. J. and W. Lord. Machinery for fluting rollers.

3454. E. T. Loseby. Ascertaining the pressure and moving force of the atmosphere.

3456. W. H. Samson. Cultivating land.

3459. J. Petrie. Valves for steam engines.

3460. M. Ker. Wardrobes or other pieces of furniture.

3461. J. G. Taylor. Dress fastenings.

3470. J. Johnston. Surface refrigerator.

3475. W. and H. Bowser. Coating or protecting iron or steel.

3481. R. Bottomley. Twisting and doubling.

3485. J. W. P. Field. Breech-loading firearms.

4. M. E. Bowra and A. E. Francis. Manufacture of elastic fabrics.

9. W. Soutter. Raising and planishing metals.

10. W. Robinson. Glasses for lamps used in ships and railway carriages.

26. S. White. Purifying, bleaching, and refining oils and oily and fatty matters.

27. W. Astrop. Manufacture of paper.

28. C. B. Clough. Curing smoky chimneys.

29. W. Tolson and C. Brown. Treating or covering strip steel or other suitable material for the making of crinoline and other similar purposes.

33. J. A. Cooper. Application of a fibre obtained from a certain plant as a substitute or to be used with silk, cotton, flax, and such like materials.

34. J. Howard and J. Bullough. Warping or beaming machines.

51. J. Whitworth and W. W. Hulse. Ordnance.

61. T. Aveling. Traction engines.

99. W. E. Newton. Application of power designed for stationary and traction engines, propellers, and other machinery. (A communication.)

117. J. A. Schlumberger. Manufacturing colours for dyeing and printing. (A communication.)

216. W. Mellor and W. Whaley. Steam hammers.

256. W. Clark. Copying and reproducing sculpture. (A communication.)

308. W. E. Newton. Reflectors. (A communication.)

320. C. and D. Faulkner, J. Fairley, and W. C. Stiff. Manufacture of gun barrels.

394. O. H. Hodge. Manufacture of hat brims.

485. W. H. Gauntlett. Manufacture of iron.

501. G. Davies. Melting and smelting furnaces. (A communication.)

622. W. Jackson and R. Watkins. Steam engines.

693. J. W. McCarter. Sawing or cutting wood.

719. W. Symington. Roasting and treating coffee and other organic substances.

861. J. Gimson. Actuating shuttles in looms for weaving narrow fabrics.

879. R. A. Brooman. Reproducing or obtaining facsimiles of the veins, pores, knots, and figures of wood upon paper and other surfaces. (A communication.)

899. R. K. Penson. Warming railway carriages. (A communication.)

906. S. A. Couperie. Semicircular metallic slide.

924. J. Ramsbottom. Machinery for hammering, rolling, and shaping metals.

962. F. A. E. G. De Massas. Peeling grain and seeds.

1020. R. Lavender. Lubricator.

1065. D. W. Fuller. Submarine lantern.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 1, 1863.

2806. W. S. Kennedy.
2987. A. C. Dewies.
2993. R. A. Brooman.
2994. R. A. Brooman.
2995. R. A. Brooman.
3006. H. Griffin.
3007. W. N. Hutchinson.
3066. E. S. Cathels.
3112. R. Hardman.
3220. W. Clark.

Sealed May 5, 1863.

1958. J. McGeary.
3015. H. Gardner.
3018. C. W. Spruyt.
3022. G. Kent and E. P. Griffiths.
3026. J. Whitaker.
3031. J. Shanks.
3035. G. F. Lyster.
3043. W. and J. Galloway.
3090. C. Littleboy.
3099. R. Brown.
3151. R. and W. Hawthorn.
3188. J. T. Caird.
3224. A. V. Newton.
3285. P. Todd.
3408. A. V. Newton.
3472. J. H. Johnson.
113. J. B. Rock.
447. F. J. Reed.
456. J. J. Badart.
618. W. Allen and W. Johnson.
631. J. Morris and T. Newton.
636. A. Wilson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1121. D. West.
1198. J. Denis.
1085. G. Masure.
1138. W. Evans.
1178. J. Chatterton and W. Smith.
1095. F. Preston.
1108. J. Gardner.
1111. J. Brickhill and J. Noble.
1119. T. Heatley and W. Paddock.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1095. F. Potts and T. Vann.
1033. R. A. Brooman.
1058. I. Holden.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending May 2, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2601	0	10	2612	0	8	2622	0	4	2632	0	4	2642	0	4	2652	0	4
2602	1	0	2613	0	8	2623	0	10	2633	0	8	2643	0	8	2653	0	4
2603	0	4	2614	0	8	2624	0	4	2634	0	6	2644	0	4	2654	0	4
2604	0	4	2615	0	6	2625	0	8	2635	0	10	2645	0	6	2655	0	10
2605	0	4	2616	0	8	2626	1	0	2636	0	4	2646	0	10	2656	0	8
2606	0	4	2617	0	6	2627	0	4	2637	0	10	2647	0	6	2657	1	0
2607	0	4	2618	0	8	2628	0	10	2638	0	10	2648	0	8	2658	0	6
2608	0	10	2619	0	4	2629	0	8	2639	0	4	2649	0	4	2659	0	10
2609	0	10	2620	0	10	2630	0	4	2640	0	6	2650	0	8	2660	0	8
2610	0	4	2621	0	4	2631	0	4	2641	0	4	2651	0	8	2661	0	10
2611	0	4															

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Timber, duty 1s. per load, drawback 1s.

Teak............ load	£12	0	£13	0	Archangel, yellow...	£13	0	£13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
,, yellow pine .	3	10	4	10	Finlan	9	0	10	0
St. John, N.B., yellow	0	0	0	0	Memel	10	0	15	0
Quebec oak, white ...	5	10	6	10	Gothenburg, yellow	10	0	11	0
,, birch	3	10	4	10	,, white.	9	0	9	10
,, elm	3	10	5	0	Gefle, yellow	10	10	11	10
Dantzic oak	3	10	6	10	Soderhamn...........	9	10	10	10
,, fir	2	10	3	10	Christiania, per C., 12ft by 3 by 9 in.				
Memel fir	3	5	3	10					
Riga.....	3	0	3	5	Christiania, yellow	21	0	23	0
Swedish	2	10	2	15	Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
Masts, Quebec red pine	5	0	6	0					
,, yellow pine	5	0	6	0	Pumice Stone pr ton	5	10	9	8
Lathwood, Dantzic, fm	5	10	6	10	Oils, &c.				
,, St. Petersburg	8	0	8	10	Seal, pale ...per tun	48	0	0	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	83	0	83	10
					Cod....................	48	0	0	0
					Whale, Sth Sea, pale	45	0	0	0
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	58	5	0	0
St. John, white spruce	14	0	15	10	Coconut, Cochin...	51	0	51	10
Yellow pine, per reduced C.					Palm, fine	37	0	0	0
					Linseed................	43	15	0	0
Canada, 1st qual. ...	17	0	18	0	Rapeseed Eng. pale	52	0	0	0
,, 2nd do......	11	0	12	0	Cottonseed	33	10	41	10

Metals.

		£	s.	d.		£	s.	d.	p ct.
Iron:—									
Welsh Bars, in London	per ton	6	10	0	to	6	12	0	2½
Nail Rods	do	7	0	0		7	10	0	
Hoops..........................	do	8	7	0		8	10	0	
Sheets, single	do	9	5	0		9	10	0	
Staffordshire Bars............	do	7	10	0		8	0	0	
Bars, in Wales	do	5	10	0		5	12	6	
Rails	do	5	10	0		5	15	0	nett
Foundry Pigs, at Glasg, No 1	do	2	11	0		2	16	0	
Swedish Bars	do	11	5	0		11	15	0	2½
Steel:—									
Swedish Keg, hammered ...	do	16	0	0		0	0	0	
Swedish Faggot	do	17	0	0		18	0	0	
Copper:—									
Sheet & Sheathing, & Bolts...	do	96	0	0		0	0	0	3
Hammered Bottoms...........	do	106	0	0		0	0	0	
Flat Bottoms, not Hamrd....	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8¼		0	0	8¼	
Fine Foreign	per ton	94	10	0		95	0	0	
Tin:—									
English Block..................	per cwt.	5	19	0		0	0	0	2½
do Bar.......................	do	6	0	0		0	0	0	
do Refined..................	do	6	4	0		0	0	0	
Banca	do	6	8	6		0	0	0	nett
Straits...........................	do	6	3	0		0	0	0	
Tin Plates:—									
Best Charcoal, I.C.............	per box	1	8	6			9	6	
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
Lead:—									
Pig, English.....................	per ton	20	10	0		23	0	0	2½
,, Spanish Soft	do	20	5	0		0	0	0	
Shot, Patent.....................	do	23	10	0		0	0	0	
Sheet	do	21	0	0		0	0	0	
White	do	26	10	0		0	0	0	
Spelter:—									
On the spot	do	18	0	0		0	0	0	nett
Zinc:—									
English Sheet	do	23	10	0		0	0	0	2½
QUICKSILVER..................	per btl.	7	0	0		0	0	0	3
Regulus of Antimony:—									
French star	per ton	42	0	0		0	0	0	2½

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE

MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 15, 1863.

OSCILLATION OF LOCOMOTIVES.

FEW subjects connected with the locomotive have met with more attention than its oscillation at high speeds. Careful experiments have been conducted, long treatises written, and discussions seemingly endless carried on, to ascertain its cause, its amount, and its remedy. In the infancy of the locomotive, regarded as a matter of little importance, we find it of late looked on as a matter of increasing moment, concerning not alone the stability of the permanent way, the wear and tear of the engine, and the economy of fuel, but even the lives and limbs of passengers: many of our most deplorable railway accidents being doubtless the result of an oscillation so excessive as to force out a rail, or break a leading wheel-flange. Nevertheless, all that has been hitherto said, written, or done, has not only failed to give us a steady engine, but even to give a satisfactory answer to the question, "What causes oscillation?" At the present moment three parties may be found, each representing our highest talent and scientific skill—one holding that its sole cause must be found in the want of balance in the reciprocating masses of the engine; another, that it is wholly due to imperfections in the permanent way; and the third, and by far the most numerous, that it is the result of both these disturbing causes. Although the opinions of the last party are doubtless correct as far as they go, still they are faulty in that they almost totally disregard one or two disturbing forces of considerable but much underated importance, to which we wish to call the attention of our readers.

Mr. D. K. Clarke conducted a very valuable series of experiments some years ago—we forget the exact date,—to determine the effect of want of balance in the reciprocating machinery of a locomotive. In order to obtain accurate results, he suspended the engine by long ropes from the roof of the workshop, and fixed a pencil to the front or back buffer beam in such a manner that the oscillation, when the driving wheels were put in motion, was registered on a cord suitably placed. The resulting diagram, with an unbalanced engine, was just ⅛ of an inch long, oval in shape, and about ½ inch wide. Weights were then applied on the trial and error system, and the result was, that the oscillation decreased by degrees, as proper weights were better distributed, until the diagram from a perfectly balanced engine dwindled down to a mere point. Such a locomotive was found to run much steadier in regular work than before it was balanced, although a ride on the foot-plate demonstrated plainly enough that it was still far indeed from being perfectly steady; better it certainly was, so much better, indeed, that it became practicable to run at speeds which it would have been madness to attempt had it not been balanced. The remaining oscillation was attributed naturally enough to imperfections in the permanent way; much of it is due to this cause, no doubt, but not all.

There are some points worthy of note in these experiments—one, that the pressure in the cylinders never exceeded the few pounds on the square inch necessary to overcome the friction of the engine, the driving wheels resting neither on the rails or a brake; another, that there was no propelling thrust whatever on the axle boxes. The experiments were perfect, and attended with the happiest results, as far as they dealt with want of balance as a cause of oscillation; but dealing as they did with an engine under abnormal circumstances, they were utterly useless as far as any other disturbing causes were concerned. They could give us no idea of the effects produced by the drag of a loaded tram, itself oscillating violently, the imperfect state of the permanent way, the want of truth in the diameters of the wheels, or many other things—trifles, it is true, by themselves, but of considerable influence when taken in the aggregate.

As unsteadiness remains after the most accurate balancing, it is quite evident that some other disturbing cause is at work; that this is not wholly due to imperfect rails, is proved by a fact well-known to most drivers, namely, that the character of the oscillation changes in any engine the moment steam is shut off, although the speed is still the same. This, it is true, may not be always evident, for the permanent way may be so uneven as to become a disturbing force, so great as to swallow up, as it were, all other causes of oscillation; but the statement is so correct, in a general way, that it might be worth while to undertake a series of experiments, which would determine exactly the character of the oscillations when the engine was, and was not, under steam at a high speed on a good and level road. We have little doubt that such experiments might afford very valuable results. We should always avail ourselves of every scrap of information, which can throw light on a doubtful subject.

Admitting, as we do in the fullest degree, that want of balance, and faulty permanent way, are two principal sources of oscillation, there remains, as we have already said, a third, which has not as yet received anything like the attention it deserves; it is simply that the centres of propulsion are constantly changing while the engine is in motion.

Most writers on this subject take it for granted that the locomotive is propelled solely by the forward thrust of the axle, or crank shaft, in its brasses—a strange error, for not only is it propelled by this thrust, but also by the direct pressure on the forward cylinder covers; and this not indirectly, but directly; and instead of the crank shaft always pressing forwards, as does the shaft of a steamer with vertical cylinders, it presses both backwards and forwards with nearly equal force, once each way in each revolution. When the piston is moving forwards, the pressure on the back cylinder lid is precisely equal to that on the piston, and of course no locomotion could be produced, were it not that the piston acts through the medium of the connecting rod and crank pin, then above the wheel centre, with a leverage equivalent to the distance of the crank pin above the rail, as compared with the distance of the wheel centre from the same. If we suppose, for the sake of illustration, that the wheel is 4 ft. in diameter, and the stroke 2 ft., it is evident that when the crank is vertical, the strain on the axle brass will be just one-third more than that on the cylinder lid; and the engine will, in consequence, advance on the rails against the retarding force due to that pressure, solely by the action of the crank shaft; but when half a revolution is completed, we find that the crank pin is now vertically below the wheel centre, and as the radius of the wheel is 2 ft., and the length of the crank 1 ft., it is evident that, so far from the crank shaft propelling the engine, it now retards it with a force just half that of the whole pressure on the piston—in consequence, the engine is wholly propelled by the pressure on the forward cylinder cover, the piston being held in space as regards the forward motion of the engine on the rails, and acting as the fulcrum for the steam in the cylinder. The pressure is thus transferred from the axle-box, which gives its thrust in a line with the frame to a point inside or outside it, according to the arrangement of the cylinders, twice in each revolution—a fact, in itself, sufficient to account for a very considerable oscillation, independently of the change of position of the centre of propulsion from a part of the engine close to the centre of gravity to one far in advance of it. If we draw a railway waggon, by a rapid succession of pulls, first at one of the front corners, then at the other, it would be folly to assert, that oscillation would not necessarily ensue, yet each cylinder lid does this many times in a second with a locomotive running at high speed.

It has been urged, however, that the wheels being keyed on a shaft strong enough to prevent sensible torsion, the thrust forwards must be the same in both axle-boxes—an assumption contrary to fact, for the forward thrust in one box, even if we supposed one cramp to be straight up while the other is straight down (which, of course, never occurs in practice), would be, in the case we have supposed, one-third more than the whole pressure on the one piston, while the tendency of the opposite piston to force the other end of the shaft against the back brass is equal to half the whole pressure on its surface. When we consider that, in actual practice, one crank is always at the dead point, while the other is exerting full power, it is easy to see that the action of the pistons must constantly tend to twist the driving shaft out of right angles with the rails by as great a distance as the play of the axle-boxes in the horn-plate will permit. It is impossible to make these boxes fit the horn, plate slides at first with mathematical accuracy, and, of course, after the engine has been a few months at work, they will get much worse; we do not think we exaggerate, when we say that, the play here may amount, on an average, to as much as one-eighth of an inch for each box. It is evident, therefore, that each side of the engine may be thrown backwards and forwards alternately, through a distance equal to this play, provided the wheels do not slip on the rails. One-eighth of an inch of longitudinal oscillation at the axle-boxes, may amount to more than half-an-inch of transverse oscillation at the forward end of the engine—an amount equal to that produced by want of balance, as demonstrated by Mr. Clarke.

If, however, the inertia of the mass of the engine is greater than the adhesion of the wheels, they may slip a little in advance of each other alternately; and the axle, no longer at right angles to the rails, will of course tend powerfully to throw the leading flanges against them, when the recoil of the wheel from the elastic rail may be quite sufficient to set up a long-continued and dangerous oscillation.

We have hitherto spoken very much as though our suppositious engine had but one cylinder; but the question assumes a very complicated form, when we consider the varying action of two pistons. We shall then find that the engine is first driven forward by the pressure of the steam on, say the left-hand cylinder lid; then by the pressure on the same lid and the right-hand axle-box; then by the strain on this box alone; then by the strain on both boxes; then by the strain on the right-hand cylinder cover, and so on; the consequence being that all these forces varying constantly, both in direction and amount, give resultants constantly changing, and seldom or never passing through the centre line of the engine. We know the result.

While considerable oscillation exists we can never have a really permanent way. It is too much the habit to attribute the derailment of a locomotive to a faulty rail. Oscillation may easily become so excessive that either rails and chairs give way, or the engine mounts the trucks. We acknowledge the difficulty of pointing out a remedy. At low speeds the oscillation is seldom so great as to be regarded as of much consequence; at 50 or 60 miles per hour it becomes a plentiful source of accident. Engines are so accurately balanced in modern practice, that we have nothing to hope from any further development of that principle. The single cylinder arrangement seems, with many drawbacks, to hold out much that is desirable; the resultant of all the forces due to the action of the steam must be central, and we believe such an engine, carefully balanced, would run almost free from oscillation, other than that due to the faults of the permanent way; the objections raised against it, of difficulty in starting trains, and the increased height of the centre of gravity, although of some weight, are far from insuperable. Many expedients might be employed to obviate the first difficulty, which would be of less importance, as this arrangement would, of course, only be applied to fast express engines, which would run 80 or 90 miles without a stop. A pilot engine could easily be provided to start them from a station, as is very frequently done now, when an express engine has a heavy train to deal with.

The second objection is of little weight. Mr. Clarke proves conclusively enough that a high centre of gravity affects the stability of an engine very little indeed, and even that need not be raised if we adopt a 7 ft. wheel, which is large enough for the highest speeds, instead of the 7 ft. 6 in. and 8 ft. wheels now frequently met with.

WROUHT-IRON BOILER TUBES.

It is well known that brass boiler tubes are generally adopted in England in preference to those of iron; nevertheless, some railway companies use iron tubes to a great extent. A difference of opinion still exists as to the comparative advantages of the two kinds; a series of experiments and a record of actual results are the only means to get at the truth of such matters. For some time the Prussian Government railways have been using wrought-iron boiler tubes for their locomotive engines. Results extending over several years allow us to believe that this kind of tubing is at least equal in strength and duration to brass tubes; while for locomotives, iron tubes are superior in economy with regard to first cost, repairs, and renewal. It is generally found that they are less subject to split in the direction fo their axes, and thus cause leakages, than brass tubes. No case has yet occurred of the explosion of one of these pipes; an accident which is not unfrequent with brass tubes. Wrought-iron tubing can also be fixed without the inside ferrules that always somewhat diminish the useful heating surface. Being of the same metal as most of the other parts of the boiler, they are subject to a similar amount of expansion and contraction by heat, and the different parts are thus better united together. The objections that have been raised against wrought-iron tubes consist in their favouring the increase of incrustation in the boiler, in being fixed with greater difficulty to the tube plates, and in forming leaky joints. With regard to the last objection, that of liability to leakages at the joints, it may be stated that this fault does not seem to be inherent to iron tubes; at least when the fire-box and smoke-box tube-plates are new, the holes are exactly drilled, and the caulking is properly done. Wrought-iron tubes, when first introduced, were naturally employed to replace those of copper or brass, and thus the holes in which they were to be fixed lost their circular shape and regularity in consequence of repairs and previous working. Copper and brass tubes, possessing more malleability, suited themselves to any irregularities, and could form tight joints, being in this respect superior to iron tubing. Generally speaking, it is to be remarked that iron tubes often require to be replaced when the fire-box and smoke-box tube-plates are in a bad state; the most frequent cause being leakages at the joints; and when iron tubes once become leaky, their ends get soon wasted away, and cannot afterwards be depended upon. The *Zeitschrift für Bauwesen* gives the following comparative results as to the use of this description of tubing. The engine No. 23, on the Aix-la-Chapelle to Dusseldorf line, was fitted with iron tubes since the year 1857; and, up to the latter end of the year 1861, the engine had run 78,747 kilometers without any accident to her tubes. On several other German lines iron tubes have been used almost exclusively since 1857-58.

Iron tubing has been used on the Westphalian net of lines since 1857. During that year six engines were made with iron tubes; and in order to institute an exact comparison as to the relative advantages of the two kinds of tubing; a few months later, six other engines were made with copper tubes. By the month of October, 1861, 214 of the 978 tubes (21·9 per cent.) contained in the first six engines had been changed. The tubes had been on an average 28 months in use, and had run 69,500 kilometres. The six locomotives, taken together, had travelled in all 295,380 kilometres, but one of the six had travelled 98,000 kilometres, which accounts for the average run of the tubing being nearly 70,000 kilometres, while the average distance run by the engines experimented with is only 50,000 kilometres. It may be taken for granted that the last engine could have run a further distance of 50,000 kilometres without using up her tubes.

In the six engines built with copper tubing there were 937 tubes; by the end of the year, 1861, 348 of these tubes had to be changed, (or 37 per cent.) after an average duration equal to 23 months, and an average run of 48,480 kilometres. The total mileage of the locomotives with copper tubing amounts to 344,415 kilometres, while that of the engine the most used equals 103,670 kilometres; and it was then calculated that the tubing would last for a further distance of 50,000 kilometres. If the iron tubes, instead of having only run 295,000 kilometres, had run 345,000 kilometres, like the brass tubes, the proportion of 21·9 per cent. of their renewal would have been raised

$$\text{to}\,\frac{345 \times 21{\cdot}9}{295} = 25{\cdot}6\,;$$

that is to say, 25·6 per cent. of the iron tubing would have to be replaced. This must be compared with the average of 37·1 per cent. given by the brass tubing. The Prussian line on which iron tubes are the most extensively employed, is the Niederschlesisch Markisch Railway; 30 locomotives are used for the traffic on that line, and are furnished with a total number of 4,503 iron tubes. Only 1·31 percent. of these tubes required changing in 1860.

According to Depretz, the conducting powers of iron and copper are respectively as the numbers 374 and 898, gold being taken at 1,000. These powers, however, are subject to great variation under the influence of practical conditions. The numbers cited above have been obtained when the surfaces of the metals were clean and bright, and were not subject to those practical influences that often completely modify the expectations formed by calculation. In the year 1857, Mr. Tosh, of Maryport, read before the Institution of Mechanical Engineers a short account of some experiments he had carried out in order to ascertain the relative conducting powers of brass and iron tubes. He used two vertical boilers of equal dimensions, 6 in. diameter and 2 ft. long, with a single tube in the middle of each 2 in. external diameter and No. 14 wire gauze thickness, of brass and iron respectively. "The two boilers were filled with water of the same quality and of the same temperature, and alternately placed upon a stand in the same position over a gas flame; they were each exposed to the action of the gas for the same length of time, which was equivalent to the same quantity of fuel being consumed in each case; and the height of water was carefully gauged after each experiment as soon as ebullition had ceased." Great care was taken to prevent any change in the pressure of the gas. According to Mr. Tosh's experiments, the evaporating power of brass is to that of iron as 125 to 100; or brass will evaporate about 25 per cent. more water than iron, with the same quantity of fuel. Experiments were also made with brass and copper tubes, and copper was found to be as superior to brass as brass to iron. The relative evaporating powers of copper and iron were found to be as 156 to 100, and, according to this result, copper should evaporate 56 per cent. more water than iron, using an equal amount of fuel. In the discussion that ensued, Mr. Tosh said that the consumption of gas had not been regulated by a meter, but a uniform pressure had been attained by applying to the authorities of the gas works.

Professor Rankine said that a number of experiments had been tried many years ago with experimental boilers of iron and copper of different thicknesses. These experiments were tried by Mr. James R. Napier, and he heated the boilers over the same gas flame, but found only a slight difference in *evaporating* power of about 1-20th or 1-30th to the advantage of the copper. Professor Rankine stated that in all experiments of the kind the state of the heating surface was an important matter; as to whether it was smooth or rough, either perfectly clean or encrusted to any great extent. The effective evaporating result, or transmission of heat through metal, as was also stated by Mr. Rankine, evidently depends on three properties:—"1st, the resistance of the first surface to absorption of heat from the heated air and gases; 2nd, the resistance of the internal particles of the metal to the conduction of heat; and 3rd, the resistance of the second surface to giving off heat to the water:—those three properties were not possessed in the same proportion by different bodies; the resistance to internal conduction was less in copper than in iron, but the resistance of the surface was greater in copper." Mr. Rankine recalled to the minds of the members of the Institution the well-known experiments on the transmission of heat, made by Mons. Peclet, who found that metals all conducted pretty much the same when their surfaces were dull. It is evident that, in the experiments we have cited, the tubing was scarcely under the same practical conditions as in a locomotive boiler. Mr. Siemens alluded to another difference, owing to any variation of the draught on the gas flame through either of the tubes carrying off the heat with greater speed; "the brass tubes might also gain an advantage from their smoother surface causing less adhesion of the minute bubbles of steam during slow ebullition, though that circumstance would not apply in rapid ebullition." It would thus appear that iron tubes are practically equal in heat transmitting powers to brass tubes. As regards duration, they actually appear to be superior to brass tubes, especially when any leakages are avoided by careful attention and workmanship. II.

WEIGHTS OF EXPERIMENTAL TARGETS.

One of the objects of the target trials at Shoeburyness is to ascertain what description of armour-plating is best adapted for the protection of our iron-clads. Two points have to be considered—invulnerability and weight. One must not be sacrificed to the other. They are inseparable. The problem is the combination of the two in the most efficient manner. Invulnerability might be attained by unlimited increase of weight. But the very nature of a ship, as a floating body, fixes a limit of weight which cannot be exceeded. This essential condition seems to be lost sight of by some inventors.

The standard of the weight of armour for a line-of-battle ship, adopted by the Admiralty, is the weight which a frigate of the "Warrior" class immerged to the load line, after allowing for the weight of the ship with her engines, armament, fuel, and stores on board, can carry consistently with her efficiency as a fast sea-going vessel.

The following table, giving the weights of targets fired at, will be found useful in estimating their relative value in practice. The Admiralty very properly attaches the utmost importance to weight, in the construction of targets, of which it sanctions the trial at the public expense.

The plan on which the table is constructed, is to regard all the materials outside the frames of the ship, including the ship's skin, as constituting the defensive armour. The frames, deck beams, and shelf pieces belong to the ship; they differ somewhat in arrangement and dimensions; they constitute the back support to the armour, as well as the structure to which the armour is attached, but they are not the armour itself. To prevent, however, any erroneous impression, it may be as well to mention that the frames of the "Warrior" and "Minotaur" weigh less than those of any other of the targets. It will be seen that the armour of the Scott Russell, Chalmers, Inglis, and Brown targets exceeds the "Warrior" standard. With regard to the two last, as they are not planned for ships' armour, the excess is only to be considered in comparing their resisting force with other targets. But the Scott Russell and Chalmers' systems being expressly designed for ships, their great excess of weight must be taken into account, in estimating their value for the public service.

The following are the weights of the armour outside the ships' frames, including the skin plates, the frames being regarded as back supports:—

	lb. p. sq. ft.
Warrior:—	
Armour plate 4½ in. thick X 40 lb. p. ft. =	180
Teak backing 18 in. = 1·5 X 48 lb. =	72
Skin plates ⅝ in thick =	25
	277
Minotaur:—	
Armour plate 5½ in. thick X 40 lb. =	220
Teak backing 9 in. X 48 lb =	36
Skin plates ⅝ in. thick =	25
	281
Samuda:—	
Armour plate 5 in. thick X 40 lb =	200
Skin plate 1 in. thick X 40 lb =	40
Plate frames 2½ in. thick = ¾ all over =	30
	270
Iron Plate Committee:—	
Armour plate 5 in. thick X 40 lb =	200
Skin plate 1 in. thick X 40 lb =	40
	240

(A considerable part of the weight of the armour to the "Warrior" was incorporated in the structure of the frame of the Committee target by increasing the strength of the frames and fixing backing plates between them.)

Scott Russell:—	
Armour plate 5 in. thick X 40 lb =	200
Backing plates 2½ in. thick X 40 lb =	100
Skin plates ¾ in. thick X 40 lb =	30
	330
Capt. Inglis:—	
Armour plates of three degs. of thickness:	
8 in. X 5 in. = 13 in. X 40 lb. =	520
7 in. X 5 in. = 12 in. X 40 lb. =	480
6 in. X 5 in. = 11 in. X 40 lb. =	440
To each of these weights is to be added the weight of the supporting bars =	40
J. Brown & Co.:—	
Armour plates 7½ in. thick X 40 lb =	300
Teak 9 in. thick, at 48 lb. per cubic ft =	36
Skin plates the same as Samuda's =	70
The heaviest part of the target...	406
Armour plates 5½ in. thick X 40 lb =	220
Teak and skin plate as above =	106
The lightest part of the target...	326

Chalmers:—		
Outer armour plates 3¾ in. thick X 40 lb. =		150
Inner armour plates 1¼ in. thick X 40 lb. =		50
Teak 15 in. thick	15	
Less 10 per cent. for thickness of the ⅜ in. iron plates	1·5	
	In. 13·5	
13·5 in. = 1·125 cubic ft. at 48 lb =		54
⅜ in. plates, 11 in. wide and 5 in. apart equal to 1 in. all over =		40
Vertical 1⅜ in. tie rods and bolt-head washer blocks let into the backing, equal per foot to		20
Skin plate ⅝ in =		25
		339

The weights of the Scott Russell and Chalmers' targets, respectively, are 53 lb. and 62 lb. in excess of the "Warrior," making a difference equal to 1·325 and 1·5 in. of iron in the thickness all over, and of 200 to 250 tons additional weight to be carried by a ship of the "Warrior" class.

HEAP'S SCREW STOCKS AND DIES.

A patent has been obtained by Mr. J. Heap, of Ashton-under-Lyne, for an improvement in screw stocks and dies. This invention consists in making screw stocks of one piece, having dies, one or both furnished with a tail screw, on which is a nut fitting in a concave recess in the screw stock as hereinafter described.

The dies are portions of cylinders or of other suitable shape, and have V-grooves fitting on similar projections in the screw stock, which is made in the form of a fish belly at the centre to combine strength with lightness and to reduce labour in constructing. The centre portion of the slot in the screw stock is enlarged to allow the dies to be put in their places and removed.

The dies may be made of cylindrical pieces of steel, which are screwed into the screw stock. Each die may be provided with three cutting recesses for screwing bolts or other articles of different diameters. Fig. 1 is a side view, fig. 2 a plan, and fig. 3 a transverse section, of a pair of screw stocks and dies. The handles or levers *a*, *a*, of the screw stocks are forged or otherwise made of the same piece as the centre portion *b*, which is made, above and below, in the form of a fish belly, as shown in fig. 3, in order to combine strength with lightness, and to reduce labour in the construction. The exterior edge of the centre portion *b* is turned in the lathe like the handles *a*, and the fish-bellied part may be either filed or ground. The dies *c*, *c*, are shown in the form of portions of a cylinder, but any other suitable shape may be given to them; the dies are made with tail screws *d*, *d*, having nuts *e*, *e*, which are convex at one side, fitting into concave recesses in the screw stock. The edges of the nuts are milled; and when the dies have to be brought closer together or set up, the workman turns the nut or nuts round or partly round. The sides of the dies *c* are made with V-shaped grooves, see fig. 3, which grooves fit on similar projections in the screw stocks; but these projections are cut away between the dies, as shown in fig. 2, to allow the dies to be put into their places or removed therefrom when required. In fig. 2 the dies are shown in their proper relative positions for screwing a bolt or other article; as soon as the screw has been cut, the attendant, by acting on the milled edge of one of the nuts *e*, liberates the dies from the screw. In changing the dies the attendant, by acting on one of the nuts *e*, draws one of the dies back until the end of the die comes against the nut; the other die is then drawn forward until the cylindrical portion comes opposite the space cut away in the centre of the screw stock; this die is then at liberty to drop out, and the other is removed in the same manner. In putting a fresh pair of dies into the screw stock, the same precaution is to be taken, that is to say, one of the screw nuts *e* is brought close up to the cylindrical portion of the die, which is then slipped into the screw stock, after which the other die follows, and then the dies are adjusted to the screws to be cut.

FIG. 1.

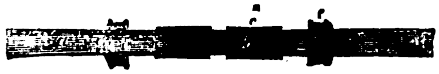

FIG. 2.

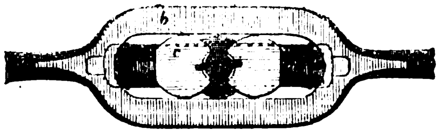

FIG. 3.

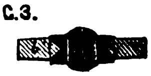

FIG. 4.

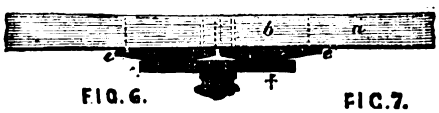

FIG. 6.

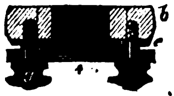

FIG. 7.

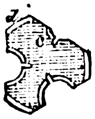

FIG. 5.

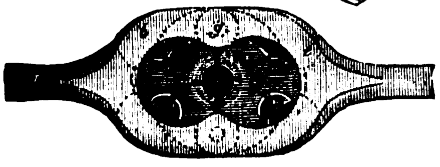

Fig. 4 is a side view, fig. 5 a plan, and fig. 6 a transverse section, of another form of screw stocks and dies. In this case the handles *a*, *a*, and centre portion *b* are of one piece, and the dies *c c*, are cylindrical pieces of steel, with three faces, fitting into similar spaces in the centre portion *b*; the dies have small shoulders *d*, seen best in fig. 7, to prevent them passing through the screw stock; they are retained in their places by the washer *f*, which is held up against the dies by the screws *g*, *g*. The dies are prevented from turning round by the plates *e* fixed to the under side of the screw stock. Each die is provided with three cutting recesses for screwing bolts or other articles of different diameters. The dies are made with three sides or faces, as the triangular form combines strength with the requisite variety in the diameter of the screws to be cut.

On referring to fig. 3, it will be seen that the groove in the dies is made diagonal instead of vertical as heretofore; the object of this is to increase the cutting action of the dies.

ON THE EDUCATION OF NAVAL ARCHITECTS IN ENGLAND AND FRANCE.*

In the buildings connected with our great naval dockyard and arsenal, at Portsmouth, there may be seen, said the author, a somewhat considerable building erected fifty years ago at a cost of £35,000. This large building is the dwelling-place of two modest officials, a clerk and an accountant, and from their tenancy the Admiralty derives a revenue in the shape of rental of £60 a-year. This building truly typifies and represents the condition of the science of naval architecture as it exists and is promoted by the Government of great naval England, and it truly represents also the provision which our nation makes for the continual supply, generation after generation, for the education of a race of naval architects worthy of the English Navy. The building in question is the Royal College of Naval Architecture. It represents truly naval science turned out of doors by the British Admiralty. It represents the naval architects of the nation expelled from their only seat of professional education, and their only source of scientific knowledge. It represents their vacant place taken by red tape, routine, and pennywise economy. It is the monument of a mutilated profession holding up in sight of the British public the stump of its right arm. There is another monument of a similar nature, less obvious, but nearer where we stand. There used to be part of a large building in London to which we could take the foreign naval architect and point out to him the last refuge of our destitute profession. There we could show him, if not principles of science, at least precedents of practice. There was a model room, almost a museum, in Somerset House, paltry indeed in comparison with those of any other country, but one in which we could point out and explain to him the peculiarities of the structures which had given to the fleets of England their known peculiarities; but this collection of precedents which embodied the principles of practical science is now also a type of the condition to which naval science has been reduced under our present Admiralty. It has been cast out of its fair rooms, it has been thrust down into a cellar, shut up in the dark, and is now effectually kept out of sight. Thus, in England, we have at the present moment professional science and education expelled from the Navy, and professional precedents and principles locked up in a cellar of Somerset House. The author next asked the audience to follow him on a little excursion across the Channel. Times, he said, have been a good deal changed of late in one respect. Naval architects, surveyors of the navy, ministers of marine, great admirals, and great naval commanders, used to come to Portsmouth, and Plymouth, and Chatham, and Woolwich, to search out and inform themselves in all that was most admirable in the design, construction, armament, and equipment of ships of war; for some few years that has ceased, and men have gone to Toulon, and L'Orient, and Paris, to see the progress and construction of the most famous and most powerful modern fleets of war, and there you now meet men of all nations assembled for that purpose. A friend conducted the author to a handsome palace in an agreeable quarter in Paris. They entered a large courtyard surrounded on three sides by a range of roomy and comfortable, though not costly buildings. It was the School of Naval Architecture. He entered and found installed in this school, and at the head of it, the eminent M. Reesch, one of the most eminent of naval architects, a good mathematician, an eminent man of science; he had occupied a distinguished position in one of the dockyard colleges, and not long ago had been transferred to Paris, where this central college of naval architecture had been established as a central point for pupils from all the dockyards of France. In this building were found all the means of an admirable education conveniently but economically provided: first, there were excellent lecture-rooms for the professors; second, there were study-rooms for the pupils; then large rooms with excellent drawing tables, one for each student, where, under the eye of competent naval architects and engineers, they make drawings, perform calculations, and produce designs; fourth, there was an excellent library, a large collection of drawings of precedents, and above all there was rapidly being formed and filled a model-room of naval structures of every kind. To show the result of this school, and the manner in which its pupils were appreciated in France, the author had only to say that so great was the demand for these trained naval architects, and so highly were they valued, that they could hardly be permitted to complete their third year of instruction. The pupils were not merely in the dockyards, but were to be found managing the largest and most prosperous engineering and shipbuilding establishments of France. The history of the School of Naval Architecture in England was soon told. It was established in 1810, because it was found by the inquiries of a special commission, that although the sailors of England were better than the sailors of any other country, the ships of England were in every respect their inferiors. Established in 1810, it was abolished by Sir James Graham, in 1833, because its pupils advocated the cause of science and professional skill as opposed to the empiricism which, at that moment, took possession of professional power in the navy—an empiricism which pretended to despise the laws of method and the principles of science, and soon met the usual fate of being trampled out by them in turn and extinguished. For more than twenty years this school sent out men fully armed with all the science of their day; but so far was the Admiralty from desiring their services, that, although forced by the country to educate them, they refused to employ them, they were denied promotion and even occupation; it was not till 1842, that they were permitted to exercise their vocation of even suggesting, advising, and making designs for new ships. Messrs. Creuse, Chatfield, and Reed prepared their designs of three classes of ships, and prepared also a report which was, in many respects, a model of systematic naval architecture as it existed at that date; their report did honour to the school which bred them; it showed what scientific education could do, because, although it was their first attempt, and although they had not been allowed to acquire any previous experience, by designing ships that were actually built, their vessels obtained with certainty and precision every condition for which they were designed; and although it had been objected that these vessels were deficient in the one quality of high speed, yet it must be remembered that no principle had gained general assent, or could be considered as fully established in their time, by which the quality of speed could be obtained with certainty, and without the sacrifice of any other good quality. The despised pupils of this school were afterwards found to be the only capable people at a critical moment when the whole navy of England had to be transformed from a sailing fleet into a steam fleet. It was most fortunate that England was able suddenly to lay its hands on a class of men of good education and matured minds in whose hands the transformation was speedily, effectually, and creditably accomplished. No sooner did the School of Naval Architecture rise into power, than they commenced the agitation of the educational question, and at the same time that they commenced the designs of their ships, something was done though only on a very small scale proportioned to their limited power for the advancement of professional education. And in 1844, there was founded once more in Portsmouth, a central mathematical school, called the School of Mathematics and Naval Construction. . . . He concluded by begging them to undertake the task of founding an English College of Naval Architecture, believing it perfectly practicable to carry it through, not without difficulty, but with complete success. There were among themselves in that room a sufficient number of able men to set going such an undertaking. The Council possessed all the skill to manage its organization, and direct its affairs. The power and weight of the society, augmented by its rapid success, and established usefulness, would give it a weight with the Government, and with the public, which it would be very difficult to resist. In such an Institution, the naval architects and shipbuilders of the private dockyards, would share equally in the advantages of high professional education; and he did not think it would be found to be without advantage that naval officers and engineers afloat should join in the completion of their studies in such an establishment; for he assured the members of the naval service present, that he knew it to be the opinion of naval officers, whose opinions were entitled to the highest weight—officers of other naval services as well as our own—that the next naval war would require of these officers, in addition to the highest skill in navigation, seamanship, and gunnery, a knowledge of the scientific properties of their ship, an acquaintance with the structure of the marine engine, a familiarity with the machinery which must steer their ships, as well as propel them, and with the mechanism which must work and divert their huge artillery, that would task the skill and science of officers infinitely more than their past service had ever done; and this he impressed on them the more now, because we stood at a transition point, where tradition, and routine, and experience of the past had become obsolete and inapplicable, and the man of the future was the man who has been acquiring unbounded knowledge, resources, and skill, and who was ready to bring them all to bear upon unforeseen circumstances and unprecedented combinations. All these wants then of every branch of the profession, the new Naval College might advantageously fulfil. What sort of course that education ought to be in detail, he would leave to the Council to consider and mature.

RECENT AMERICAN INVENTIONS.

At a recent meeting of the Franklin Institute, Philadelphia, Mr. Howson exhibited diagrams and models of A. B. Cooley's apparatus for obstructing rivers, consisting of a series of blocks or frames chained together, and anchored at each end of the series to one of the sides or shores of the river. Each block resembles a tetrahedron in shape (the points being tipped with iron or steel), so that upon whatever side the block may lie, a sharp apex will be presented, which should be about 5 ft. below the surface of the stream. The blocks are at such a distance apart that no war vessel of formidable size can pass through the channel without coming in contact with one or other of the frames. When no longer required to obstruct the channel, the blocks may be disconnected and separately removed.

Mr. Howson also exhibited several breech-loading firearms. The first is the invention of L. H. Gibbs, and manufactured by W. F. Brooks, of New York. In this arm the trigger guard is used as a lever, on depressing which the barrel is thrown forward, and tilted up at the rear, so as to expose the breech ready to receive a load. Another arm, the invention of B. F. Joslyn, of Connecticut, is closed at the breech by a cap hinged to the side and rear of the barrel, and is so constructed as to automatically discharge the empty cartridge case from the gun, on unclosing the breech.

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* Read before the Institute of Naval Architects by Mr. J. Scott Russell, F.R.S., March 28, 1863.

H. Liebert's substitute for gunpowder was exhibited. Its principal ingredients are prussiate of potash and cyanide or ferro-cyanide of potassium. A powder composed of these two substances, in combination with nitrate of soda, charcoal, sulphur, and other ingredients, any or all of which may be employed, can be compounded without that danger of explosion which is incurred in making the ordinary substitutes for gunpowder, in which chlorate of potash is generally used.

Mr. J. N. Pierce, of Darby, Delaware Co., Pa., exhibited numerous specimens of artificial slate, for the use of schools, colleges, &c. On painting any suitable surface with a preparation, patented by Mr. Pierce, a slate-coloured ground will be formed which answers equally as well as slate for drafting or marking purposes. Paper, linen, or ony textile fabric may be used to form convenient portable slates, which can be rolled or folded up for transportation. Mr. Pierce also exhibited pencils made of talc.

INSTITUTION OF MECHANICAL ENGINEERS.

The general meeting of the members of this Institution was held on Thursday, the 7th inst., in the Lecture Theatre of the Midland Institute, Birmingham; Sampson Lloyd, Esq., in the chair.

The Secretary (Mr. W. P. Marshall) read the minutes of the last meeting, and several new members were elected.

The first Paper read was "On the Construction of Drawing Rollers, &c., for Spinning Machinery," by Mr. William Weild, of Manchester. After a reference to the early applications of machinery for spinning cotton fibre into thread, the present method of spinning was described, in which the sliver or bundle of cotton fibre is passed through a succession of grooved or fluted rollers, each pair running at a higher speed than the preceding pair, whereby the cotton fibres in the sliver are gradually drawn out and laid regularly side by side in continous juxtaposition, ready for being finally spun into thread by the twisting motion of the spinning machine. In the ordinary drawing rollers, the lower roller of each pair, which is the only one driven, is fluted with small grooves cut in its surface by a kind of planing machine, parallel to the axis of the roller; and the upper roller being covered with leather and held down upon the lower by a weight, its softer surface becomes gradually indented or fluted by constantly pressing upon the straight flutes of the lower roller; the cotton fibres are then irregularly stretched or broken in passing between the two rollers, causing the thread spun to become irregular in thickness. The success of the process, however, depends entirely on the uniformity of the thread being constantly maintained; and this grooving of the upper roller has now been successfully prevented by the writer, by forming the grooves on the lower roller in a spiral direction, instead of straight grooves parallel to the axis of the roller, whereby the upper roller bears always upon a number of grooves at the same time, instead of upon a single straight groove. The method of fluting the lower roller has also been improved by the writer, by the substitution of a milling process, indenting the flutes in the surface of the roller, instead of the ordinary plan for planing them out by a cutting tool, whereby the grooves were left with a keen edge and a slight burr, which would catch the fibres of the cotton, requiring a tedious hand process of rubbing down after the grooves had been cut, to finish the roller for use in the drawing machine. The milling is performed by a steel milling tool, with a narrow milled edge, which is the counterpart of the spiral flutes to be formed in the roller; this mill is pressed into the surface of the roller at one end by a heavy weight, sufficient to make it indent the roller; and the roller being made to revolve underneath it, the mill is traversed along the entire length of the roller. The milling is effected very rapidly, and completes the fluting of the roller at one operation, leaving it with a finished surface ready for immediate use in the drawing frame. The distance between the successive pairs of drawing rollers being determined by the length of fibre of the cotton to be drawn, the rollers are required to be closer together, and therefore smaller in diameter, for short-fibred cotton than for long-fibred; and for drawing the shorter-fibred cotton now being introduced from the new sources of supply in India and China, smaller diameters than those hitherto used are required: rollers made of Bessemer steel have accordingly been applied by the writer with advantage, this metal allowing of their being made small enough in diameter for the shorter fibre, and yet sufficiently strong at the coupling socket joints.—Specimens of the milled rollers and milling tools were exhibited, and of the Bessemer steel rollers, with full size working models of the sets of drawing rollers shown in action.

The next Paper read was "On the Locomotive' Engines in the International Exhibition of 1862,' by Mr. Daniel K. Clark, of London. Twenty locomotives altogether were exhibited, of which eleven were English and nine foreign; and fourteen had outside cylinders, and six inside cylinders. Most of the engines were specially constructed for burning coal, a feature which has been introduced entirely since the former Exhibition of 1851, on account of the smaller cost of coal for fuel compared with coke. The English engines were mainly examples of the standard classes in general use on the principal English railways; of the eleven exhibited, seven had outside cylinders and four had inside cylinders. The foriegn locomotives showed greater variety, boldness, and originality of design, and were mainly constructed for lines with very heavy gradients and sharp curves, which are generally associated together on railways in mountainous districts, causing special mechanical difficulties not applying to the cases of the English railways. The most satisfactory of the plans for surmounting these difficulties is considered by the writer to be that of an articulated or bogie engine, having a single long boiler of large dimensions, mounted on two separate carriages, with a swivelling connection, each having its own separate pair of cylinders, working six coupled wheels placed near together: so that the engine, although of great total length, could readily pass round very sharp curves, whilst the whole of the weight is made available for driving adhesion. The other principal engine of this class, the "Steierdorf," in the Austrian department, was a tank engine of very large dimensions, carried on ten wheels, the six leading wheels being coupled together as usual; and the additional adhesion on the rails is obtained by coupling together the four trailing wheels also, which are driven from the leading wheels through an intermediate shaft, with spherical bearings for all the coupling rods, so connected as to allow of the two sets of wheels assuming any angle to each other in running round sharp curves, the engine frame having an intermediate swivel joint for this purpose. A marked feature of the foreign engines is the position of the valve gear outside the cylinders; but this is considered objectionable in respect of good working and durability. In the larger foreign engines also, as well as in some of the English, the boiler tubes have been crowded too close together, with the object of obtaining larger extent of surface, from a mistaken idea that heating surface is mechanically the equivalent of evaporative power, without regard to the equally important consideration of the circulation of the water amongst the tubes; in the extreme instance of 356 tubes, fixed with only 7-16ths inch clear space between them, a large proportion of the tube surface must be practically inoperative for raising steam. Another marked difference between the engines exhibited in 1851 and those shown at this Exhibition is that in the latter Giffard's injectors have been extensively employed as a substitute for the feed pumps universally used at the former period.

The meeting then terminated.

INSTITUTION OF CIVIL ENGINEERS.

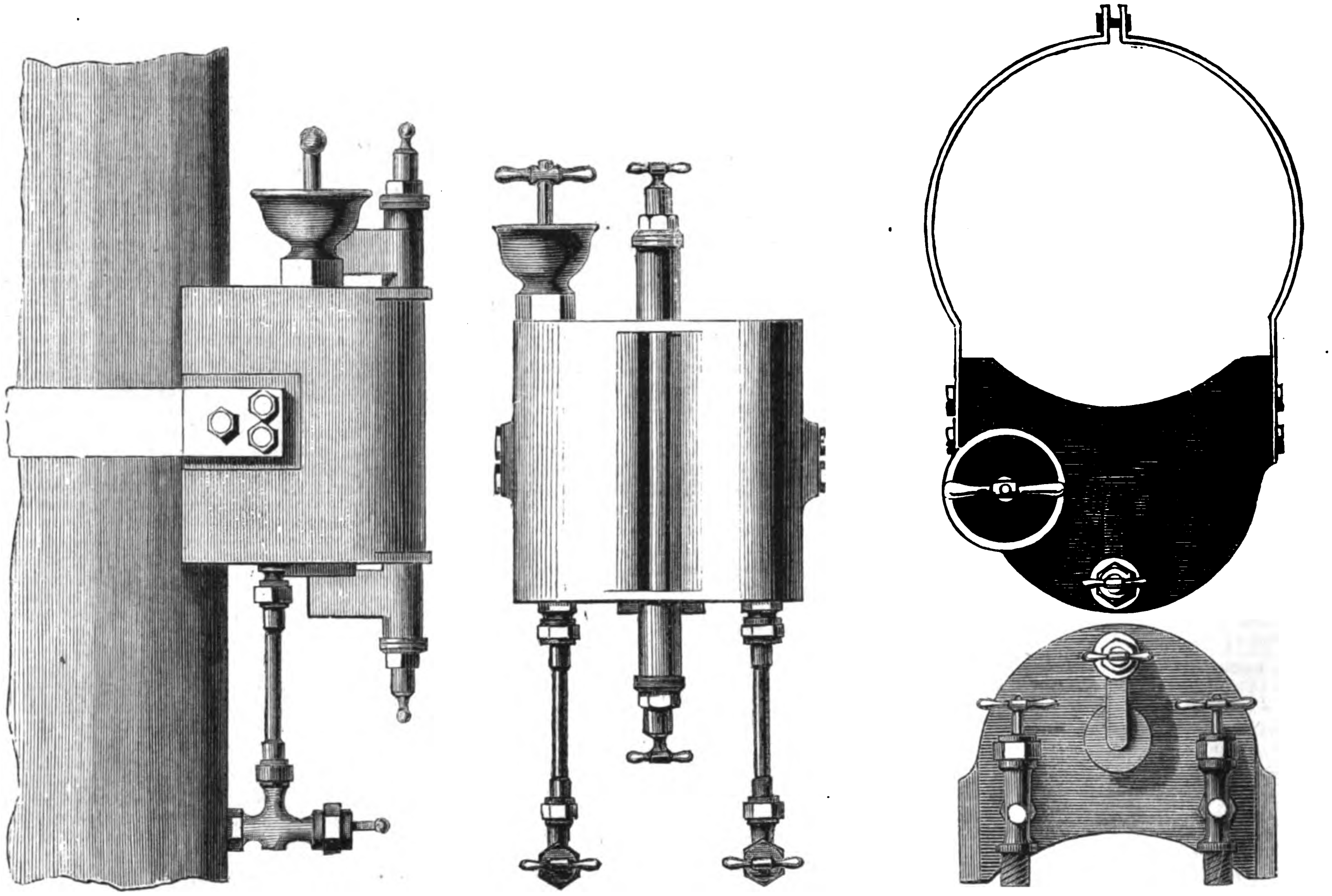
On Cellular Iron Backing to Armour Plates.

At the meeting of the 25th February, 1862, in the discussion on Mr. Samuda's Paper on Iron Plated Ships, Mr. George Clarke made some remarks on iron cellular backing, of which, as the subject is one of public interest, we give a summary, and especially as a target built on Mr. Clark's principle is about to be experimented upon at Shoeburyness. After showing by an analysis of Mr. Samuda's plan that his arrangement for strengthening armour plates was a system of panelling, of which the panels would be 6 in. and the frames 7½ in. in thickness, Mr. Clark said:—We have, then, this simple proposition, the weakest part of the plates being 6 in. in thickness, do they present an effective resistance to the force of projectiles? I think not; from the results of trials I have seen, I believe 100-pounder and 68-pounder shots would penetrate or break through 6 in. of iron unsupported at the back. These panels are placed exactly in the position to be easily punched, a hollow space being left under the part where the force will be most effectively applied. The result will be, to facilitate penetration. If, moreover, the panel be struck, each blow of the shot will have a tendency to curl up the edges, producing the effect termed buckling.

From what I have observed of buckling, and the diversity of opinions on that subject, it appears not to be properly understood. No turning-up of the edges could take place unless the plates were driven in at the centre or one of the ends. In the trials where buckling was most apparent, the backing has been of wood, which not offering sufficient resistance, the plate was crushed into it, and buckling took place. It is worthy of observation that, in all the experiments, the principal damage was caused by the wood backing yielding to the effect of the blows. In the "Warrior" target trial, from the effect of the last salvo, the iron was crushed into the wood in the area of impact, and the ends of the plate was forced upwards away from the backing 1½ to 2 in. But in experiments on plates with a backing of iron, as in the trial of Mr. Fairbairn's target, whenever the projectile struck a plate over the frames, the iron did not yield so much, being only indented. Another remarkable instance of the same effect was exhibited in experiments of the Iron Plate Committee on a plate 2½ in. thick, backed with cast-iron blocks. A 40 lb. shot produced no impression on the plate except an indentation of scarcely half an inch, and then a 100-pounder struck the plate near the edge, and slightly grazed the head of a bolt, which, acting as a wedge, split off a piece of the plate and of the cast-iron backing, but the plate was only indented three-quarters of an inch. I have come to the conclusion that the essential point in armour plating is the backing on which the plates are fixed. If it is of sufficient hardness, rigidity, and strength of structure to resist the crushing effect of shot, the penetrating effect will be reduced to a minimum, and much thinner plates than those now adopted will answer the purpose better. I think attention ought to be turned to that subject more than any other.

The question of backing is connected with that of fastening. Under any circumstances I consider the through bolt objectionable. It is exposed to impact, and, if struck, is a source of damage to the plate, which is weakened by the bolt-holes. Mr. Samuda's arrangement aggravates these objections. He places the bolts in lines along the edges of the plates, having only an inch of iron outside. If a bolt in this position is struck, it will fracture the plate and separate it from its fastening. But the greatest danger to be apprehended is that tendency of a plate to buckle, which, in my opinion, arises entirely from the want of rigid backing all over, and will be the inevitable result of Mr. Samuda's plan. Without an effective fastening there cannot be a perfect system of armour plating. But with an efficient fastening, and a backing of such hardness and strength as to support the plate effectually, the highest degree of perfection might be attained. It had been said that backing of solid blocks of iron was too heavy for a ship to carry. That is true; but I believe a backing might be constructed on the cellular system, presenting the iron edgeways, which would offer an effectual support to the back of the armour plates, and admit of diminishing their thickness considerably. That, in my opinion, is the true system to be followed out to obtain the object in view. In the construction of the cellular backing, the size of the projectile has to be taken into account. The cells should be so much narrower than the diameter of the shot, that at every blow two cells at least should be covered by the impact. With this arrangement there would be such

CLEMENTS, LLEWELLIN, AND JAMES'S SELF-ACTING LUBRICATOR FOR STEAM ENGINES.



a degree of support afforded to the armour plate, that the effect of heavy shot at the highest velocity might be resisted.

From models and drawings I have prepared, I have come to the conclusion that it will be advantageous to distribute the greater part of the quantity of iron to be used as armour in strengthening the backing. Taking the iron and wood together in the "Warrior" armour, we have a weight equal to 6¼ in. of iron all over. By distributing that weight of iron with judgment, reducing the armour plate to 2½ or 3 in., and disposing the other portion as backing in a cellular form—some outside and some inside the ship's skin—we might, without exceeding the weight of 6¼ in., obtain with backing and armour plate together a thickness equal to 20 or 24 in., and by that combination, I believe, the great problem of rendering ships invulnerable will be solved.

CLEMENTS, LLEWELLIN, AND JAMES'S SELF-ACTING LUBRICATOR FOR STEAM ENGINES.

In our number for April 3, p. 255, we described and illustrated an apparatus for supplying a regulated quantity of lubricating material to the inside of the valve-box and cylinder of an engine. The lubricator is fixed to the steam-pipe, and the current of steam is the primary agent. We would refer to the above number for a general description of the apparatus; but, in justice to the inventors, we feel bound to notice several improvements in detail that have been lately made, and which are shown in the annexed engravings. It will be noticed that the air and discharge valves are placed at top and bottom of the gauge glass fittings; while the arrangement of these latter is altered, so as to have the entire range of the glass. Conical plugs and stuffing-boxes are substituted for the common cocks, previously used; and the valves are placed on the steam-tube, instead of on the bottom of the lubricator. For fixing the apparatus, a simple wrought-iron band is made to clip round the steam-pipe.

TESTING CHAIN CABLES AND ANCHORS.

Mr. Laird has introduced a Bill into Parliament for enforcing a test of chain cables and anchors used in the merchant service. This has been several times proposed before, but without obtaining an Act for the purpose. The matter, we believe, does not now require the intervention of Parliament at all; for, since Lloyds have undertaken to prove all chain cables and anchors voluntarily brought to them for that purpose, Government, the India Board, and the Emigration Commissioners have refused to charter any vessel the ground tackle of which has not been tested up to the Admiralty proof, and a certificate given accordingly. This refusal operates hardly less strongly than a compulsory Act, perhaps, indeed, even more strongly. In one case the penalty for non-testing would be, perhaps, a few pounds; in the other case it amounts to a disability involving a loss of the most valuable charters in the shipping trade. It is true that there are thousands of craft which have but little chance of ever being chartered by Government, or the India Board, or the Emigration Commissioners, and these, we might suppose, could therefore dispense with all tests of their cables and anchors. But as the ships to be engaged as transports or as emigrant ships cannot be positively known beforehand, it is almost certain that the majority of ship-owners will desire to prove at least the eligibility of their vessels, and thus sufficient stress will be laid upon this as to induce most, if not all, owners to "qualify" accordingly.

For every ship in the Navy there is a minimum length and size of stud-chain cables, hawsers, and warps, and a minimum number and weight of bower, stream, and kedge anchors. For steamers the chains and anchors need be equal only to those of a sailing ship of two-thirds their total tonnage. Thus, for a 1,000-ton sailing ship, or a steamer of a total tonnage of 1,500 tons, she must have at least 300 fathoms of 1¾ in. stud-chain cable, tested up to 55 1-10th tons, and weighing 23 tons 6 cwt., with three bower anchors of 2 tons each, one stream anchor of 12 cwt., and two kedge anchors, one of 6 cwt. and one of 3 cwt., the bower anchors to bear a test of 35 tons 15 cwt. Lloyds' Committee have adopted the Admiralty requirements, and only grant certificates where these are fulfilled. We may observe here that the Admiralty test of stud-chain cables is 630 lb. per circular ⅛ in. of the diameter of the iron of which the chain is made: thus a chain 1 in. or 8-8ths in. in diameter has 64 circular eighths of an inch, and 64 X 630 = 40,320 lb., or 18 tons exactly. Now the section in the two sides of a 1 in. link is 1·57 square in., and thus this test amounts to a strain per square inch of 11·46 tons, a test which is the same per square inch whether the cable is ¾ in. or 3 in. in diameter. The breaking strength of good cable iron may be taken as from 24 tons to 27 tons per square inch; but, even with iron of this quality, the link, when made up, generally breaks at about an angle of 45 deg. with its own axis, and under a strain not often more than two-thirds of that which would have broken the two sides of the link before it was made up. This 1⅛ in. iron, of the strength of 27¾ tons, often breaks, when made up into a stud-link, at 43 tons, instead of at 55½ tons, the sum of the original strength of the two sides. And as such a cable, 1⅛ in. in diameter, is tested up to 22¾ tons, this, it will be seen, amounts to more than one-half of its actual breaking weight. Open-link chains are proved to but two-thirds of the strain of the stud-link, or cable chains.

The proving-house of Lloyds' Committee was erected last year under the superintendence of T. M. Gladstone, C.E., in the New-road, Poplar, contiguous to the West India Docks. Heretofore chain cables have been tested in lengths of 12½ fathoms only for the Navy, and 15 fathoms for the merchant service, these lengths being afterwards connected by shackles up to any length required. Mr. Gladstone prefers, however, to prove from 60 to 75 fathoms at a time, and the proving house, of galvanized iron, is nearly or quite 500 ft. long. At the southern end are the offices, weighing machine, hydraulic press, and pumps. A railway extends the whole length of the building, and there is also an iron trough, about 18 in. deep, running the same distance, and in which the cable is placed when under strain. All the mechanical operations of handling and proving chains and anchors are performed by a steam travelling apparatus, designed by Mr. Gladstone, and called the Dromedary. This a substantially made steam crane, mounted upon a four-wheeled truck, and, furthermore, provided with means for its own propulsion as a locomotive, and also for underrunning cables, and for driving a set of hydraulic pumps. As a crane, this machine will lift, swing, and lower 10 tons. Stationed near the pumps, and working through a universal joint, it will, in a few minutes, get up any required strain up to 300 tons in a length of 73 fathoms of cable, and in other ways it is so serviceable that but six or seven men, including engineman, smith, and labourers, are employed in the entire work of bringing in a cable or anchor from the docks, and testing, repairing, and delivering it again. The cost of the Dromedary, we are informed, is but £650. The cable is hauled out of a barge afloat by a light windlass, and coiled upon a truck. This is taken by the Dromedary into the proving-house, and slowly down the line of rails abreast of the trough in which the chain is to be laid for proof. During this journey of the truck, which occupies but a few minutes, over the distance of 450 ft., the cable is let off, by the same light windlass, and deposited upon the floor. A large broad-grooved sheave, suspended from the jib of the Dromedary, is then got under the cable, and with the sheave properly adjusted in its position, the Dromedary underruns the whole length of 75 fathoms in about 9 min., thus hoisting the cable into the trough without its being touched by hand. The trough is nearly or quite 2 ft. wide, and has iron sides of a total section of nearly 60 square inches. These are fastened by stout flanges at the bottom to the heads of piles, driven deeply into the "made ground." At every 15 fathoms there is a cross-bar, so that 15, 30, 45, 60, or 75 fathoms may be tested as required, the longer lengths being preferred for convenience. The cable, being made fast at one end to one of the cross-bars of the trough and at the other to the cross-head of the hydraulic press, is ready for testing. The hydraulic press is horizontal, and forms one end of the trough. It has a bore of 16 in. and a piston rod of 8 in. diameter, the annular area for pressure being thus about 150 square inches. The press cylinder is long enough to allow of a 10 ft. stroke. The highest intended pressure is 2 tons per square inch, equal to total strain of 300 tons, but the 2¼ in. cables of a 3,000 ton ship require a proof strain of but 91 tons, and the proof of even the "Great Eastern's" cables is but 167 tons. The permanent friction of the press, which friction is not much affected by the pressure to which it may be worked, is 11 cwt., and it is seldom that a greater pressure than half a ton per square inch requires to be applied by the pumps. The Dromedary being run up alongside these, and a universal joint slipped upon the pump-shaft, the pressure is quickly got up. A machine for exactly weighing the strain applied is fixed in a room near by, and from which there is a view of the whole length of the cable. The pressure of the water is received through a small copper pipe upon the end of a gun-metal plunger ¾ in. in diameter, attached to a scale beam provided with moveable weights. The strain is increased until the scale beam rises under the proof weight, when the cable is struck four or five smart blows with a sledge hammer at about the middle of its length. No accidents have yet happened to the workman striking these blows; but we should suggest a falling weight, to be released by a trigger tripped by a long cord. The strain is kept on three or four minutes, during which the cable is carefully examined throughout. When breaks occur, it is almost always at a weld, and a large number of links never welded through one-tenth of their cross section have already been found since the proofs commenced last November. A large mooring link made by a first-class firm for the Peninsular and Oriental steamship "Poonah" was broken the other day at an imperfect weld. Many cables go, at every 15 fathoms length, almost as soon as the least strain is put on. When the cable breaks in two the broken ends draw apart within the trough, and it is seldom that a fragment of a link flies out, in which case its course is upward, owing to the form of the trough. The roof of the proving-house has not yet been hit, however. Broken links, if not too frequent, are welded up again at the owner's expense. The forge for this purpose is mounted upon a light truck, and is thus moved to the work instead of bringing the work to the forge. When the cable has been tested, it is underrun from the trough and coiled upon a truck, and taken away by the means already described. The charge for testing, examining, weighing, and certifying chains is 10s. per ton, with an increased rate for chains under 1 in. For re-testing the charge is 5s. per ton. Anchors are tested at a charge of 10s. for each arm. Links are repaired at a fixed scale, according to diameter. If a chain will not bear the Admiralty strain on the third testing, a certificate will be given up to within 10 per cent. of the breaking strain if required. The test for an anchor is about two-thirds that for its corresponding cable, and no anchor is certified if the permanent set of one arm exceed ¼ in. The details of the proving establishment are exceedingly simple and effective, and do much credit to the engineer, Mr. Gladstone.—*The Engineer.*

IRON BRIDGE MAKING IN WORCESTER.

A new description of manufacture, says the *Worcester Chronicle*, has of late been developing itself in this city, namely, that of iron bridge-making for railways and other large works. Messrs. M'Kenzie, Clunes, and Holland, of the Vulcan Works, near the railway station, mechanical engineers, have latterly been manufacturing such bridges on a very extensive scale. By means of a first-rate plant, and machinery of the most scientific character, this energetic and enterprizing firm seem to have succeeded in naturalizing, in this city, a species of manufacture usually thought to belong specially to the mining districts, and give employment to between 300 and 400 hands. One of the works just executed at the Vulcan Works is an iron bridge intended to carry a railway across the river Spey, in the north of Scotland. This is the Morayshire Railway, which communicates with Elgin and Lossiemouth, and forms a junction with the Strathspey line at Craigellachie. The bridge is constructed to have four openings, or waterways, one of which, 200 ft. wide, forms a passage for the river, and the others, which are each 57 ft. span, are to carry off the floods which often occur in that district. The bridge altogether approaches 400 ft. in length, but is only 17 ft. in width, the railway having only one pair of rails at this point. The bridge is built upon what is called the "lattice-girder" principle. The framework of each girder is made of the stoutest boiler-plates, and the interstices of the framework are filled in with strong bars of angle-iron crossing each other diagonally, and thus forming a gigantic lattice-work. Hence the name of this kind of girder. The portion of the bridge intended to cross the Spey being the most important portion of the work, was put together in the yard of the Vulcan Works, and attracted the attention of all who passed along the road by its great size and singular appearance. Had it been covered in at the top, it would have resembled somewhat a tubular bridge with lattice-work sides, but sufficient strength for a span of 200 ft. was obtained in the two girders, which stood up like enormous balustrades to the height of about 18 ft. These were kept in position by means of what are called "diaphragms," which stretch across the roadway of the bridge from girder to girder, with wide openings in them to allow for the passage of trains. There were five of these diaphragms strongly bolted to the most substantial portions of the framework of the girders, so that with machinery sufficiently powerful, the lifting of one portion of the work would have been the lifting of the whole. The floor of the bridge ran nearly in a straight line from abutment to abutment, with very slight rise. The rapid manner in which the machinery punched out the rivet-holes in the stout metal, which seemed but as so much paper undergoing the operation, was looked at with some astonishment by the spectators, and the speed with which the iron fabric grew in size, from day to day, was equally a source of wonder. The bridge has now been removed, and we believe is by this time fixed in its intended position over the Spey. It is to be supported by strong abutments capped with iron; and an arrangement of friction rollers is contrived to allow the various lengths of the bridge to expand and contract by heat and cold, without injuring these abutments. The ironwork of the bridge weighs about 300 tons, and by the contract was to bear a tensile strain of 20 tons to the square inch; this, it it is said, was considerably exceeded. Having provided a bridge for the accommodation of the Morayshire travellers, the same firm is now, we believe, engaged upon one for those of Wales. This is to carry an ordinary road over a creek or estuary, and by forming a junction with two turnpike-roads —Abergele and Rhyl—will save a wearisome detour of about 14 miles. This bridge is also on the "lattice-girder" principle, and will span four openings, three of which are 76 ft. wide, and one 40 ft. The portion of the bridge above the 40 ft. opening will be constructed to draw back, as at our Upton bridge, to allow of the passage of vessels on the water. The bridge will be supported by iron piles, and will be 21 ft. wide. The roadway will be of wood, covered with road metal. The junctions of the four lengths of the bridge will be finished off with cast-iron pilasters of an ornamental character. In this bridge about 122 tons of wrought iron will be consumed. The engineers for this bridge, which is built for the Rhyl Bridge Company, are Messrs. Piercy and Hughes; and the contractor is Mr. Savin, who, like Mr. Piercy, is well known in the Welch districts for his extensive railway operations. The engineers of the Morayshire bridge are Messrs. Samuel and Mills. The boiler plates and angle-iron for both structures were supplied by Messrs. J. and F. Hall, the well-known ironmongers of the city. Lest our speaking of Messrs. M'Kenzie, Clunes, and Holland as having devoted their attention to bridge-making may lead to misapprehension as to the nature of their manufactures, we think it right to add that there is nothing within the ordinary range of mechanical engineering which they do not execute. Among the great variety of articles which they turn out are considerable numbers of metallic piston rings, made under the patent of Mr. Edward Wilson, of the West Midland Railway. We saw the other day at the Vulcan Works a set of these nicely-adjusted metal hoops, intended for the engines of one of the largest steam frigates in Her Majesty's Navy.

MALLET'S FOLLY.

One of the most promising objects in or near Dublin was "Mallet's Folly," a huge oblong building standing on the north bank of the Royal Canal. It was built by an Irishman named Mallet, who signally failed in his speculations. Since then "Mallet's Folly" has been falling into decay, and for a long time has been the home of bats, swallows, and the ivy. Messrs. Murtagh Brothers have recently restored the building in a most remarkable manner, and what was known as "Mallet's Folly," is now known as the "North City Flour Mills." The internal arrangements, says the *Freeman's Journal*, are most complete, and calculated to give on inspection much pleasure to all interested in mechanical engineering. The several departments on the lofts are admirably arranged for their purposes, and the means by which the steam and water power is distributed to do all kinds of work in different localities is most simple and ingenious. The water power amounts to about 40 horse (nominal) and the steam to about 200. It would be an arduous and lengthy task to enter into anything like a description of the several departments of this great concern; but it will be sufficient to say that it is in every way one of the finest establishments of the kind in the kingdom. At present, the machinery is working 19 pairs of millstones, and provision has been made for 40 pairs at full work. Although the waters of the canal flow at the base of the North City Mills, the Messrs. Murtagh have adopted the wise precaution of having a plentiful supply of water at a high pressure. To effect this great object they have got an iron tank erected on the top of the building 4½ ft deep. This tank is capable of containing over a million gallons of water, and is constantly kept full by the engine. On each loft a cock and screw is affixed to the down pipe, to which, in case of fire, a nozzle hose could be attached, and extinguish even a formidable blaze in a moment. A large towering furnace chimney recently built at the mills, is the highest in Dublin. Some extensive machinery has been constructed and erected by J. Rowan and Sons, York-street Foundry, Belfast. It is a magnificent specimen of a single condensing engine, and the largest in Ireland. To see it in its ponderous and majestic strength doing its work would well repay a visit. Some notion will be formed of its magnitude when it is known that the fly-wheel is 28 ft. in diameter, and the driving wheel 25 ft. Its length of stroke is 7 ft. The cylinder is what is known as "45 in.," and the engine is capable of working up to 200 horse, at the low pressure of steam on the valves of 25 lb. to the square inch. It is furnished with Rowan's patent double-beat valves, and "fluctuating patent slider" which acts in concert with the governor to cut off the steam at any point of the stroke according to the load; and, as a specimen of engineering and skilled manufacture, it could not be surpassed by anything produced in any other country. The two circular horizontal boilers are furnished with double furnaces, and supplied with Rowan's superheating apparatus. The consumption of fuel to sustain the above-named pressure for twenty-four hours is within 50 cwt. of common coal. The machinery is finished in excellent style, and in keeping with the whole establishment, which, we have no doubt, will soon illustrate how native commercial spirit and enterprize will turn

HYDE'S PATENT FLOATING BATTERIES.

FIG. 1.

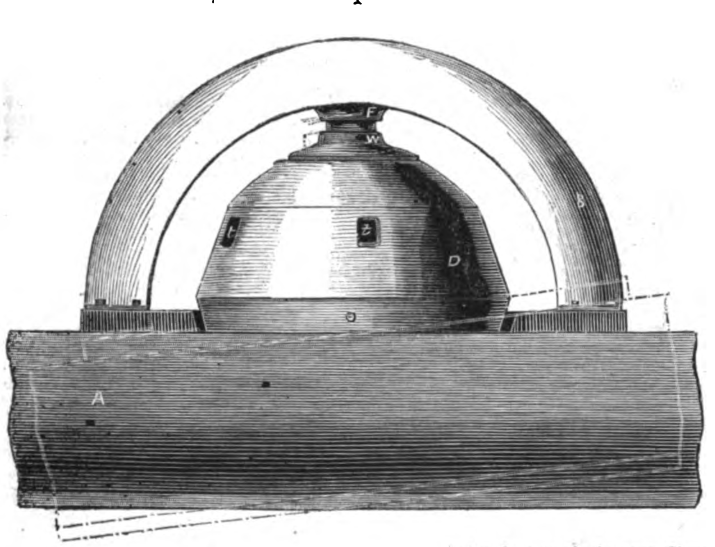


FIG. 2.

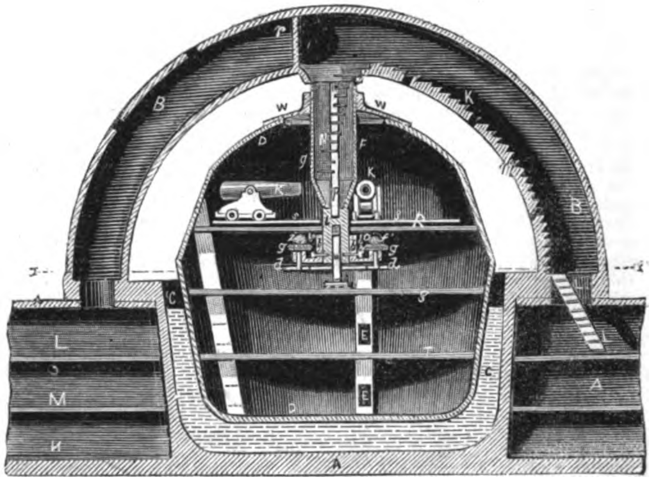
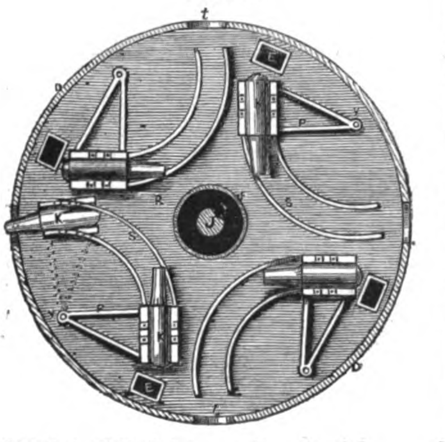


FIG. 3.



"Mallet's Folly" into profit and wisdom, and teach a lesson to all Irishmen to be self-reliant, true to themselves and to one another, and to leave no "Mallet's Folly" at which the finger of the scorner can point.

HYDE'S PATENT FLOATING BATTERIES.

MR. J. HYDE, of New York, U.S.A., has recently obtained a patent in this country for an improvement in floating batteries. The invention consists in the employment of a shot-proof turret, as represented at figs. 1 and 2 in the accompany engravings, and so arranged as to float in water contained in a suitable reservoir or compartment formed within the ship's hull, the centre shaft of which is sustained by hollow frames, forming at the same time a communication between the inside of the ship and the inside of the turret by a suitable passage way through the hollow frames and through the central shaft, and also in the arrangement of the gun running on curved railways. Near the centre of the ship's hull a reservoir or compartment is formed, nearly filled with water or any other suitable fluid, in which floats the turret or gun-house. A hollow arch-like frame extends from the hull over the turret, from which projects downwards a hollow shaft, into the lower end of which a stud or shaft is fitted, capable of sliding freely up and down, and connected to one of the floors or decks of the turret through a universal joint. A system of gearing is arranged around the lower part of the hollow shaft and connected with the central stud, whereby the same, and consequently the turret, can be turned or rotated in the reservoir. By virtue of the universal joint, the turret is also free to tip in any direction, in consequence of which the careening of the ship will not affect said turret so much, the tendency of the water in the reservoir being to maintain its level, whereby the turret is caused to float in a level condition, while the hull tips, whereby a greater degree of accuracy can be obtained in firing the guns than can be arrived at in the present mode of construction.

The guns are made to travel on circular railways, as clearly shown at fig. 3, in the shape of a quarter of a circle, the carriages being constructed with suitable sector frames, which are hung at one end on pivots fastened to the deck around which the carriages travel. By this arrangement less space is required for the guns, and consequently a greater number of guns can be arranged in one turret, and capable of being fired directly opposite each other. Suitable elevators or dumb waiters are arranged in the turret through which the ammunition is passed up from the lower decks of the turret to the guns, as may be required.

THE EFFECT OF SHOT ON THE "NEW IRONSIDES."

THROUGH the attention of an officer on board the "New Ironsides" we are enabled to present our readers with a diagram of the effects of the rebel shots which were fired at that vessel during the recent attack on Fort Sumter. The injuries were very slight; the vessel was struck in all about ninety times, we are told, but the most serious damage she received is here depicted. Previous to describing the diagram we will let our correspondent tell his story in his own way:—

"MESSRS. EDITORS.—We have had a fight with Fort Sumter and Moultrie; but as there was a reporter for one of the New York papers on board, I will not go into a description of it, except to speak of the effect of the shot on our plating. In reference to the 'Keokuk,' I will state, primarily, that I was informed by one of her crew that she received 89 shots through her plating, 15 of which were below the water line, also that a 32-pounder pierced her bow. The 'New Ironsides' received very little injury; the worst being the loss of one of the iron port-lids; it was knocked off by a rifle shot supposed to have been fired from Fort Moultrie. I examined the iron, and it appears to be crystallized, as the break was short off, although it was in the weakest part. Our plating stood the test very well, as the shot that struck seem to have broken into pieces. There was a rifle shot taken out of our stern, where it had buried itself in the wood. Enclosed please find a rough sketch of some of the marks which the 'New Ironsides' received."

Fig. 1 is a representation of a spent rifle shot found in the wooden stern of the ship after the engagement. The body of the shot is 6 in. in diameter and 10 in. in length, and is, as the reader will discover, a most formidable instrument for offence. The bands at the base and the forward end produce—the one, the necessary rotation to the missiles by expanding into the grooves; the other centres the shot in the bore of the gun, so that its flight will be true after leaving it. The piercing end of the missile is rounded, and it is in all respects the very counterpart of those projectiles which inventors at the North have experimented with and proved to be the most effectual against armour; thus showing conclusively that the rebels have full and early intelligence of every mechanical novelty of merit. Fig. 2 is a section of the inclined armour of the "New Ironsides," showing the indentation of the shot at A, and also the wooden backing of the plates at C and D. The shot broke in pieces and flew off without penetrating or disturbing the backing, although it came very near it. Fig. 3 is a view of the broadside of the ship, and shows several scars. The port-lid A was broken off, and lost overboard, by being struck at B, near the point of support, by a rifle shot. The plate E was struck by a round shot at D, which cracked the armour in the line C; the shot made an indentation 1 in. deep by actual measurement. The fractured port-lid was also struck, before it was finally detached, by a round shot at F. The shot carried away the edge of the lid, and, striking the main armour, glanced off and made the long "blaze" at G. The plate H was struck at J by a rifle shot, which glanced off after breaking the plate on the line K, also scarring the timber backing: the armour ends at that point. One rifle shot also struck on one of the bolts that hold the plating to the ship, and made an impression $2\frac{1}{2}$ in. in depth. Some of the rifled shell of the enemy entered the "New Ironsides" bow, but were prevented from doing any damage by the precaution of the commander in placing sand-bags at that point. Without this protection the shells would undoubtedly have done considerable damage. The ship ought to be as completely iron-clad as the "Roanoke" is. She would then be more effective against an enemy than in her present condition. The "New Ironsides" is not completely iron-clad, but only on those points covering her broadsides; the bow and stern are left undefended, as in some of the English vessels. She took an active part in the fight at first, but afterward fell back out of range, being unmanageable. The channel is tortuous at that point, we are given to understand, and the ship could not obtain sufficient momentum to get

GREENWOOD'S STAVE-CUTTING MACHINERY.

FIG. 2.

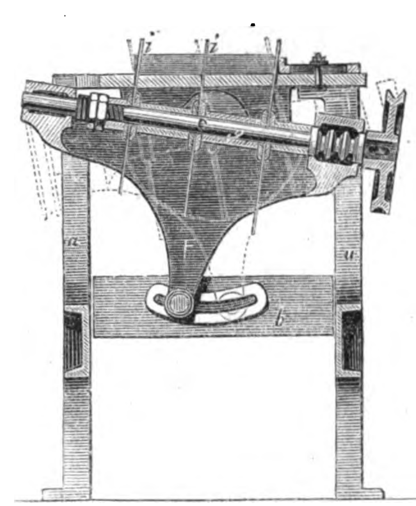
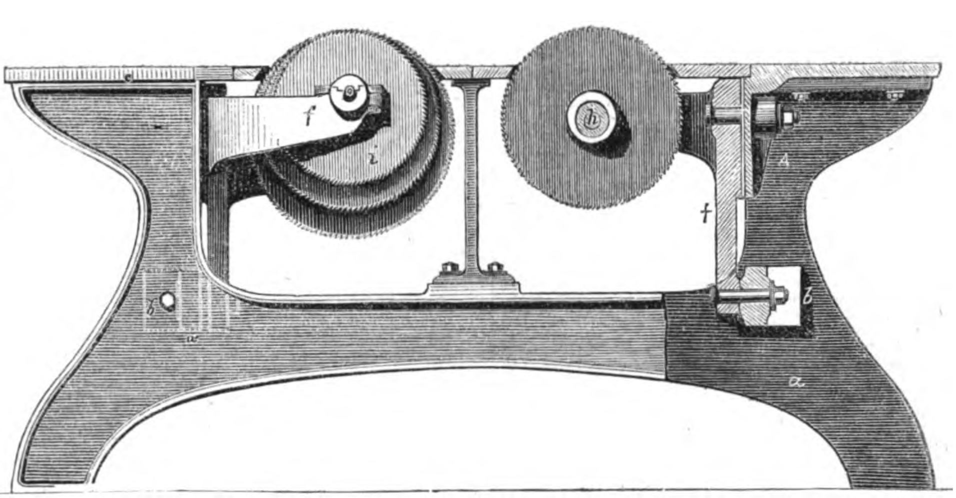


FIG. I.



steerage way on her. We are unable to say at what range the rebel shot took effect on the "New Ironsides," nor do we know what charges of powder propelled them. That they struck at a low velocity, however, must be inferred from the fact of the rifle shot sticking in the woodwork. The ship was also unable to deliver her broadsides with good effect, and fell back as before stated. When all things are more propitious than on the last occasion, we do not doubt that the ship and the brave fellows who command and man her will give a good account of themselves.—*Scientific American.*

EFFECT OF SHOT ON THE "NEW IRONSIDES."

FIG. I

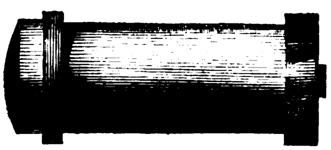


FIG. 2.

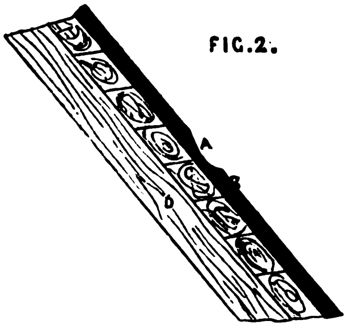
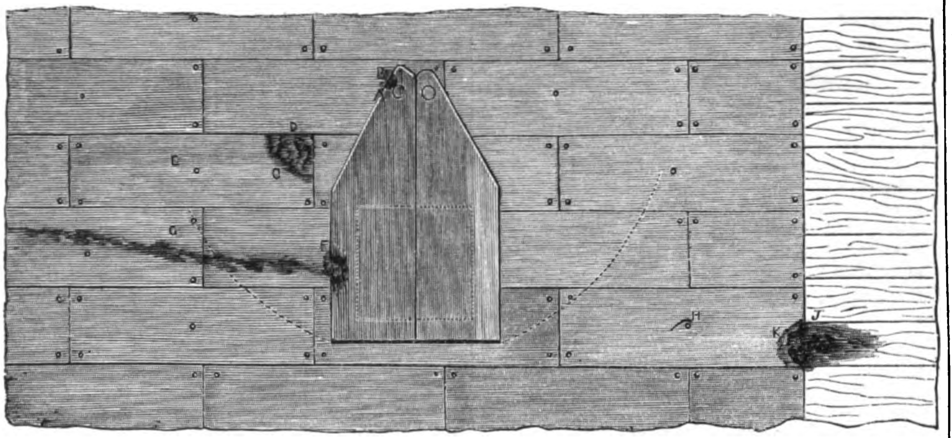


FIG. 3.



GREENWOOD'S STAVE-CUTTING MACHINERY.

The accompanying engravings illustrate an arrangement of machinery for cutting staves for casks.

The object of this invention is to facilitate the operation of cutting or shaping staves from planks of wood, such staves being intended to be applied as a cylindrical covering for metal casks, and for analogous uses. The wood is submitted to a sawing machine, which at one operation will cut the bevelled edges of the staves. The machine is provided with a double set of oblique saws, the shafts of which are inclined in opposite directions, but at the same angle; and for the purpose of bringing the cutting edges of each set on a level, or nearly so, the saws are made of varying diameters.

In the accompanying engravings fig. 1 is a side elevation, partly in section, of the improved machine; and fig. 2 is a transverse section of the same. *a a*, are the side frames of the machine coupled together by cross-bars *b b*, and by plates *c*, which form a portion of the table of the machine. These plates are cast with pendent pieces, which are faced up to receive each a swing bracket *f*. The brackets are cast with arms to embrace and carry the saw shafts *g* and *h*, which turn freely in suitable bearings provided to receive them. That portion of the brackets which is in contact with the pendent pieces is also faced up to ensure close contact between the parts for the purpose of obtaining steadiness in the brackets. The brackets are carried by fulcrum pins, which pass through the pendent pieces, and are tightened up by nuts on their outer ends. The lower end of each bracket is furnished with a screw bolt, which enters a segment slot in the cross-bars *b b*, and receives a nut for clamping their respective brackets in any required position. Mounted on the shafts *g h*, are the sets of saws *i i*, the one consisting of an odd number of saws, and the other of an even number for a reason that will be presently understood. These saws project through slots made in moveable plates (forming portions of the table), in order that they may reach their work, which is moved forward over the table. For guiding the wood up to the cutters the table is provided with an adjustable guide.

It will now be understood that any amount of obliquity may be given to the saws by simply slackening the screw bolts, and moving the saw shafts to the required angle, and then clamping them to secure them in their new position. The change of obliquity is needed to suit various kinds of work, it being understood that as the wood is brought up and fed past the first set of saws while the same are rotating, oblique, parallel or bevelled cuts will be made through the wood in one direction, the angle of the bevel corresponding to the obliquity of the saws. After passing the first set of saws the wood will come under the action of the other set of saws, and these being mounted obliquely in the opposite direction, and at a corresponding inclination, will cut the opposite bevel for the staves, dividing the already severed portions of the plank equally down the middle. When the saws are intended to be set at an extreme position, it may be necessary to change the table plates for others whose slots will not interfere with the saws taking the new angle of inclination desired to be given to them. By reference to fig. 2 it will be seen that the action of this machine is to cut the wood into bevelled staves in a manner that will give waste pieces only at the edges of the plank. The saws, it will be seen, are mounted in the usual manner on their shafts, and they are at equal distances apart, the relative positions of the saws of the two sets being such that the second set which comes into action will divide the severed portions of the plank evenly down the middle. The saws driven by bands from any prime mover, pass over pullies on the ends of the shafts. For presenting the wood to the saws and holding it firmly under the action of the saws, any suitable or well known contrivance may be adopted.

It is reported that a party of travellers have succeeded in discovering the sources of the Nile.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

RECEIVED.—V. P.—A. G.—W. P. M.—B. H.—J. N.—A. G.—G. C.—J. C.—J. A. D.—T. H. and Co.—Prof. T.

W. K.—We could not co-operate with you in the matter.

J. A. DAVIS.—In our next.

T. L. M. (Belfast).—The work that will probably suit your purpose best, is the "Treatise on Cast and Wrought Iron Bridge Constructions," by William Humber. (E. and F. N. Spon, Bucklersbury, 1861.)

S. M.—We are always most willing to give any advice in our power, and you may rely on our good faith, if you think it desirable to show us your scheme.

T. F.—We would refer you to a review of Hopkinson's Work on the Indicator, in a late number; in that article you will find most of the rules for calculating the horse-power of steam engines.

T. L. (Bradford).—Before your invention was provisionally registered, you would have some difficulty in selling it, as you would have to explain the scheme to anybody desirous of being a purchaser. Save up your money, and in the mean time, by careful study and thought try to ascertain the true value of your idea; you could then patent it or provisionally register it yourself.

EXQUIRER.—Arthur Woolf was not the inventor of the "compound," or the combined high and low pressure engine. This can be proved by referring to the old specifications of Hornblower and Roberton.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

◆

THE CHALMERS' TARGET.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The experiments at Shoeburyness are a national institution. Their object is to determine the best system of attack and defence in naval and military warfare. Upon them will greatly depend the safety and independence of the country. It is of the highest importance that the experiments should be properly reported and correctly appreciated; and, above all, that the conclusions drawn from them should be practical and sound. The phenomena exhibited at the recent trial of Mr. Chalmers' target are so remarkable they deserve especial notice. Your report shows that his system is stronger than any other system to resist penetration, but weaker to resist smashing. It is interesting to examine the causes of these apparently contradictory results.

In the structure which constitutes the Chalmers' target, the peculiar feature to which the success obtained is due is the rigid backing. It is composed of alternate horizontal layers of teak planks and iron plates, the former 11 in. wide and 4½ in. thick, the latter 11 in. wide and ⅜ in. thick. This arrangement, in principle, is an iron cellular backing, the cells being formed by the edges of the ⅜ in. iron plates abutting against an inner 1¼ in. vertical plate. The teak planks are the filling to the cells.

The inherent weakness of this mode of construction is obvious. The ⅜ in. iron plates having no flanges, are not riveted or otherwise fastened to the back plate, they only abut against it with their edges; and they, as well as the teak planks, are simply piled one on the other. The designer, to unite these loose parts, has recourse to the expedient of tying the planks and iron plates together vertically, by means of 1 in. iron rods with screw ends and nuts; and he fastens the backing horizontally with bolts through some of the planks screwed up inside the skin. He also uses marine glue to cement the parts together. In this plan, there is an evident want of cohesive strength. For the passage of the vertical rods, numerous holes are perforated in the planks and plates forming the backing, of which the strength of resistance to smashing force is thereby greatly diminished. On the other hand, the horizontal bolts through some of the teak planks afford but a feeble hold to the ship's hull. The armour-plate bolts do nearly all the work of maintaining the backing in its place. This, on a ship rolling in a heavy sea, would be a serious defect. The backing ought to be securely fastened to the ship independently of the armour plates.

Another source of weakness is the teak planking interposed as a "cushion" or elastic medium between the backing and the ship's side. This coating of wood, 4 in. thick, is a break in the continuity of rigidity. The resistance offered by the iron cellular system ceases at the line of contact with the teak "cushion," which being a yielding material, must be crushed in if the projectile force is sufficient to penetrate the outer armour plate.

The correctness of this view is proved by the tremendous smashing effect on the target of the 300-pounder shot fired with a charge of 45 lb. The destruction in this case was far greater than that produced by the same projectile force on the "Warrior" target. The shot passed clean through the Chalmers' target unresisted, and then struck against a 9-inch solid iron Hawkshaw target in the rear, with so much force as to burst it open behind. But at the "Warrior" trials, it will be remembered, that two or three of these heavy missiles encountered so much obstruction from the solid teak backing, they were stopped by the iron skin, and did not penetrate into the inside of the ship. This remarkable difference must not be lost sight of. It is accounted for by the frail nature of the structure composing the Chalmers' backing.

But, nevertheless, it must be acknowledged, that rigidity of backing has achieved a great success. Plates 3¾ in. thick resisted penetration from 110, 68, and 200 pounder solid shot fired singly and in salvos at 200 yards, better than 4½ and 5½ inch plates at any former experiments. The amount of buckling was comparatively small, and consequently the bolts were not strained. The salvo of 5 guns destroyed seven or eight bolts of the "Warrior" section; it broke only one of the Chalmers' target. The result in the former case, and the damage to fastenings generally, in other experiments, are to be attributed, as I have often pointed out, to the distortion of the plates arising from their being bedded either on wood or an iron skin without backing.

The result of the experiments on Monday last goes far to prove the efficacy of rigid backing; but to obtain its full amount of resistance, in proportion to the weight of materials, the principle must be carried out to its full extent in combination with perfect cohesion of all the parts of the structure.

The extra weight of Mr. Chalmers' target must also be taken into account. The following calculations show that the armour outside the ship's skin weighs full 60 lb. per superficial foot more than that of the "Warrior," and about 70 lb. more than that of the "Minotaur."

WEIGHT OF MATERIALS IN THE CHALMERS' TARGET.

	lb. per sq. ft.
Outer armour plate 3¾ in. thick .... =	150
Inner do. 1¼ do. .... =	50
Teak 15 in. thick .... 15 in.	
less 10 per cent. for thickness of the ⅜ in. iron plates = 1·5	
inches .... 13·5	
13.5 in. = 1.125 cubic feet at 48 lb. =	54
⅜ in. plates 11 in. wide and 5 in. apart equal to 1 in. all over .... =	40
Vertical 1¼ in. tie-rods, backing, bolts, and washer blocks equal per foot to	20
	314

WARRIOR ARMOUR.

Armour plate 4½ in. .... = 180 lb.	
Teak 18 in., or 1.5 cubic feet X 48 = 72 lb.	
	252
Excess of weight in Chalmers' target per ft.	lb. 62

In these calculations, the armour-plate bolts and the ship's skin and frames are not taken into account on either side. If they were, the excess in the Chalmers' target would be 12 to 15 lb. more. The skin is the same, ⅝ in. thick, in both. His bolts being 2¼ in., whilst those of the "Warrior" are 1½ in., the former with the nuts and washers weigh nearly double, and his frames being 18 in. whilst those of the "Warrior" are 22 in. apart, and he having, moreover, two double frames at the centre, the total number of frames in his target is 10, whilst for the same length (13 ft. 4 in.), the number of "Warrior" frames is 7. It may then be fairly stated that the Chalmers' exceeds the "Warrior" target in weight by 60 lb. per square foot. This is equal to 1½ in. increased thickness of iron all over, and ought to give much greater strength of resistance than the former. Nevertheless, as the trial proved, its resistance to smashing effect is considerably less.

As to the "step-necked bolts," it is impossible to determine whether they contributed to the result obtained. The heads have less holding surface than a conical head, and are more likely to sheer off. The truth, probably, is that the rigid backing preventing distortion of the plates, the bolts were not strained and consequently less liable to be broken or damaged.

When the armour plates are removed it will, no doubt, be found that in the region of the impact of the two salvos, the loose compound of planks, and thin plates, is crushed into the cushion or coating of teak against the skin. Unless that were the case, the frames, it is to be presumed, could not be bent inwards out of the perpendicular to the extent they are, for the force of the salvos, unless it had crushed through the backing and reached the skin, could not have produced the local effect exhibited by the arching of the frames.

There is another point in the construction of the Chalmers' target, giving it an immense advantage over the "Warrior," or any other target tried at Shoeburyness. The height between the deck beam shelf or bearing plates is only 5 ft. 7 in. out of 10 ft. (the height of the target), so that more than 2 ft. of the top and bottom have a solid support, imparting greatly increased rigidity and resisting force to the whole structure.

There is no foundation for Mr. Chalmers statement that his system of backing adds to the strength of the ship. The contrary is the case. The continuity of cohesion, as well as of rigidity, is entirely broken by the "cushion" of wood. The cellular backing, *per se*, is fastened to the skin only by the horizontal bolts through the teak planks. If the armour plates were removed, the entire backing might tumble off from a ship rolling and pitching at sea. The vertical tie rods are mechanically an inefficient contrivance. It could not, moreover, be applied to curved surfaces, and is therefore inapplicable to the sides of a ship.

The real merit of the Chalmers' target is the cellular backing, which, misapplied as it is in his form of arrangement, nevertheless proves the immense value of the rigid principle, which I have so often advocated in your journal.

It may be fairly contended that the experiments on iron armour with wood backing have led to erroneous conclusions, especially with regard to the size and joints of plates. With a perfectly rigid backing and perfect rigidity of cohesion, it will probably be found that smaller plates will resist better than larger ones, and that plates of 3 in. or 4 in. in thickness will do their work more efficiently than plates 6 in. or 7 in. thick with wood backing.

These are considerations of importance in an economical point of view. They are receiving the attention they deserve from Government, and will be solved in a few months by a series of experiments on a large scale, for which preparations are in progress at Shoeburyness.

CIVILIAN.

OCEAN TELEGRAPHY.

SIR,—I should be glad to enter more fully on the subject of Ocean Telegraphy, which the letter of "H. K.," in your last number, would seem to invite, but I have not the time at my command to give that attention the matter requires; and an ill-considered opinion is worse than none, and would only lead to such interminable arguments as to tire your readers without benefiting the cause.

"H. K." proposes a scheme to support an oceanic telegraph cable on submerged buoys, and he invites my opinion, which I give, by saying that I consider it impracticable, and state my reasons for so believing; but he is not satisfied, and seems to cavil at every word. I will, however, endeavour to set the matter of floating or suspended telegraph cables at rest, even to the satisfaction of "H. K.," and that without altering the grounds of my argument, viz., "the insuperable difficulty attending placing the buoys."

In all mechanical and engineering ploblems, when we speak of things being impracticable or impossible, it must of course, be taken for granted that the present state of our knowledge in science and mechanics is considered; for rash indeed would be the man that, with the wonders of science and skill of the present day before him, would deem anything impossible; but I am more warranted in using the word in the present case, as it is not a matter of science and engineering, for, did my life depend upon it, I would prefer trusting the mooring of the proposed buoys to a good boatswain than all the combined scientific and engineering skill in England.

"Britannia rules the waves," and the schoolmaster afloat soon found out she did not rule them straight. Admiral Fitzroy, with all his skill as "clerk of the weather," could not insure a fortnight or three weeks' dead calm between this and America—if "H. K." can, it is another matter; but with the ordinary course of nature, I will give an idea of the "modus operandi" that would have to be be taken to carry out "H. K.'s" project; but, before proceeding, I will observe that Captain Selwyn is right—one ship must of necessity carry telegraph cable, buoys, mooring anchors, and cables, even though all the fleet of Great Britain were placed at the disposal of the telegraphic engineer; and the reason is obvious—wind and sea will often prevent any communication between two ships, without which, were the buoys in one ship and the cable in another, the two could not be united.

The ships have met in mid-ocean or straight, they wait for a fine day to commence operations, and at last secure one; a good sounding is obtained, say 2,300 fathoms; the surface current is tried ("H.K." grants that), one of half-a-knot is found. The sounding lead has taken one hour to go down, consequently the ship or boat taking the sounding has drifted in that time 500 fathoms. Given the rate of descent of each 100 fathoms and the rate of the surface-current required, the reduction to be made from quantity of line run out, for depth—we will guess (for there is no rule by which it can be ascertained) and deduct 250 fathoms, which is near the mark, that the actual depth is 2,050 fathoms. We will keep the boat moored to the sounding line, so that the anchor shall be let go on the same spot as nearly as possible—the buoy is ready, anchor let go, chain or hemp cable (whichever "H. K." pleases)—as it runs out, it is bent to the buoy at 2,000 fathoms. The telegraph cable, in the mean time, is successfully spliced and attached to the buoy. The buoy and cable dissapear, whether to go down 20 or 200 fathoms, or more, does not signify, so "H. K." says, although I have myself seen an iron nun buoy collapse when a ship's anchor has been let go in deep water with too short a buoy rope; but we will allow "H. K." to make his own buoys, and grant that they will stand the pressure at the depth.

The cable ships separate, and the cable is paid out; a breeze springs up (which, sooner or later, it will), and on the second day, when it is time to lay another buoy, it is blowing strong, with a good sea on. The sounding ship must sound; there can be no waiting for the weather this time; she rounds to for the purpose, but cannot keep head to sea; she heaves the sounding lead, fails, heaves again, loses lines, and at last signalizes that she *thinks* there is 2,000 fathoms; as to allowance for drift, surface current, &c., that is out of the question, and there is even doubt as to whether the sinker had reached the bottom at all. However, the buoy must be moored; the cable is bent on at, say, 1,800 fathoms, and mooring anchor gone—out it runs, and away goes buoy No. 2, when, if it is strong enough to bear the weight of its own cable, it may be seen dancing away on the top of the waves to windward; as to picking it up and shortening the cable, you might as well whistle for the buoy to go down the required depth. The cable ship may have been waiting for the sounding, most assuredly she would for mooring the buoy, during which time the cable *must* run out—light or heavy cable, it must go, the send of the sea and pitching of the ship will prevent any stoppage, except at the risk of the cable, and the ship may be miles from the spot where the sounding is taken before the anchor is at the bottom.

Now, Sir, I will ask any reasonable man if this is a matter of mere "adjustment," or any sailor if I have overstated the case. A real gale would finish the matter, and buoys, cable, and all would be lost. Thus, I think, I am quite warranted in saying the scheme is impracticable from "the insuperable difficulties attending laying the buoys," and that being the case, it is useless entering on such subjects as the nature of the buoys, cables for mooring them, accessibility of the telegraph cable for repair when laid, and many other serious and important questions, combining a great many etceteras not calculable by any rule of science or engineering—indeed, I believe it would be equally practicable to erect posts across the Atlantic, and thus have an atmospheric line, as to moor buoys for the purpose of supporting a submerged one.

I might safely leave the other objections to my arguments unanswered; but I repeat that at the bottom of the ocean there is no *superincumbent* pressure. As to the barnacles and weeds that "H. K." takes objection to, he has only to run down to Leith, obtain a handful of both from some ship's bottom, and throw them into the sea, when he will soon see if they will sink. And as to the question of the suitability of the bottom for the cable, I conceive my opinion, for the reasons given, is as good as any "H. K." can form on mere hypothesis.

Hoping this letter will satisfy "H. K." that his proposed mode of suspending submerged cables is impracticable,

I am, Sir, yours, &c.,
AN OLD SAILOR.

AN ATLANTIC TELEGRAPH.

SIR,—The statement made by Captain Selwyn, in your journal of 24th April, in support of the alleged existence of under-currents, particularly in the open ocean, is anything but conclusive. I may mention, with reference to what he says, that I have all due respect for eminent hydrographical authorities; but I am very far indeed from believing that they, or any other authorities, are infallible, nor do I suppose that the captain himself will contend that they are. When they assert anything to be true, the question remains open for the fullest and most searching discussion whether the facts bear out their assertion; and if it is not borne out, their authority, it is quite clear, ought then to go for nothing; although it has too often the very bad effect of imparting stability to error of greater or less duration, and more or less obstructive of the course of improvement.

I regret I have not seen Sir Edward Belcher's letter, referred to by the captain. But if its facts, or alleged facts, are of the same kind, and if its arguments are no better, than those of Captain Maury in his Chapter on Currents, it is a matter of very little moment. But the Admiral, in his own evidence, annexed to the Report on Submarine Cables, states a fact (page 245, question 4,298), the plain conclusion to be drawn from which seems to me to be most hostile to the existence of under-currents.

Captain Selwyn himself admits the singularly instructive fact stated by Commander Dayman, and quoted in my letter in your journal of 10th April. The captain says that he never knew another instance of the kind. But he must bear in mind that the Commander says that this occurred *twice*, and that during the comparatively short time in which he made soundings in the North Atlantic. Such an occurrence showed that there must have been complete stillness in the air, and in the water on the surface of the ocean, and all the way down to the bottom. Now stillness in the air, and in the water on the surface of the ocean, cannot, in the nature of things, be expected to occur often together; but, when they do occur, the result is as stated by the Commander, leading to the clear conclusion that there are no under-currents in the North Atlantic, nor, it may be further deduced, anywhere else in the open ocean. Those who assert the contrary must prove it.

The Captain says that boats, and even ships, have been carried forward at a considerable rate against surface currents by sinking an iron pot or other heavy body, exposing a large surface, 100 or 200 fathoms deep, so as to be acted on by the stronger under-currents. But Captain Maury's book contains one, and only one, alleged case of the kind, said to have occurred no less than 200 years ago in the Baltic. Captain Maury also quotes an apocryphal statement about what is alleged to have happened to a Dutch ship in the Gut of Gibraltar about 150 years ago—the statement also asserting that the Gut was very deep, and could not be sounded by the longest lines, which assertion is now known to be altogether untrue. The two stories bear all the marks of being untrustworthy; they have never been reverified in any way, though of such very ancient date; and, in short, according to all the recognized rules of judging of evidence, are not entitled to any credit whatever. Captain Maury also relates what was done by Lieutenants Walsh and Lee, U.S.N., by means of a block of wood loaded and sunk so far into the ocean after being tied to a floating barrel, when they allege the barrel made progress at the rate of 1 or 1¾ knots per hour against tide, wind, and surface current. But the time and place when and where this occurred is not specified. And the great question arises in this as in all similar cases, Was it the boat or the barrel that moved? The answer to which must be, in all probability, it was the *boat*, acted on by the tide, wind, and surface current, which are expressly admitted to have existed and operated together at the time of the experiment. And it is on these three small, miserable, most unsatisfactory, most inconclusive evidences of a direct kind that Captain Maury raises his huge system of under-currents, and on which Captain Selwyn rests his belief in its truth.

And what do they say is the cause of the alleged under-currents? Capt. Maury thinks they may arise from the difference in the specific gravity of the waters of the ocean—such consequences from such a cause being the pure offspring of his own imagination. Capt. Selwyn thinks that surface currents probably cause reciprocal under-currents; but why or how they should do so he does not say, and it is evident, from the use of the word "probably," that he does not know—that it is, in short, the mere offspring of his own imagination also. But the children of imagination, to whom facts are hostile, must speedily perish. The Captain, no doubt, refers to the Gut of Gibraltar as being a familiar instance of this reciprocal motion. But where is the proof of any such motion existing in the Gut? Does he refer to the old apocryphal story of the Dutch ship already alluded to?

Commander Dayman believes, and is fully justified in believing, from the soundings made by him above referred to, that there are no under-currents in the north part of the North Atlantic (Report, p. 385, q. 3211-2). Now this is the very place where the proposed surface cable would be laid. The absence of under-currents there, therefore, is all that I need really care about, and is all that is necessary for the present purpose. But still I may add that, if under-currents do not exist in that region of the ocean, why should they exist in any other region? The alleged facts, which are supposed by Captains Maury and Selwyn to cause under-currents, should exist and operate in the north part of the North Atlantic just as well as anywhere else. And since these alleged causes are found not to operate in the production of under-currents in the North Atlantic, why should we believe that they opereate to produce them anywhere else? And with reference to Commander Dayman's conclusions, I beg leave, with all due respect, to inform Captain Selwyn that I must attribute vastly more weight to such conclusions, deduced from actual observed facts, by a man so thoroughly and practically experienced in the matter as the Commander, than to the groundless suppositions and the imaginative speculations of Captain Maury and of himself.

No doubt, Captain Selwyn says, that on numberless occasions, after a regular descent, at gradually increasing intervals, he has seen and known the sounding line to be gradually increased in velocity of descent by the effects of an under-current. But the Captain here begs the whole question by saying that the acceleration was caused by an under-current. That is the very point in issue, and must not be assumed. I have seen, in the lowering of a bucket from a windlass down to the water in a well, the same sudden acceleration occur. Aqueous under-currents, as the cause in such a case, is out of the question. If Captain Selwyn had not been misled by the notion of these supposed under-currents in the ocean, and had sought the true cause of the accelerated motion in something else, he would no doubt have found it; for it is fully believed that it will admit of a very simple explanation, irrespective of under-currents altogether. To show a similar case of erroneous conclusion, drawn from the very same fact of acceleration in sinking, by a person having a predominant idea in his mind different from that in Captain Selwyn's, I would refer to Mr. Newall's evidence annexed to the Report on Submarine Cables, p. 252, q. 4419.

In short, the proof, such as it is, in support of the existence of under-currents in the ocean, fails entirely on every point. The belief in their existence, no doubt, originally sprang from under-currents existing in the atmosphere; but there is far too great a difference between thin gaseous air and dense liquid water—there is so great a difference in their mobility—that it will not do to argue that because under-currents exist in the one, they must exist in the other also. In truth, Captains Maury and Selwyn, by a strange inconsistency, admit this so far, because they both grant that under-currents do not exist at the bottom of the ocean,—but why, consistently with their views, Captain Selwyn has not explained, though I requested him to do so.

To make the matter on this point still clearer, indeed it may be said absolutely clear, it may be remarked that we know that it is the solar heat that sets the atmosphere in motion in horizontal under-currents and otherwise. This is accomplished by the solar heat easily penetrating through the thin air of the atmosphere down to the surface of the earth, which it warms, and where it thus accumulates, and then powerfully reacts upon the atmosphere, setting it in motion and giving rise to currents. But it is altogether different with the dense water of the ocean, through which the solar heat can only penetrate a very few feet down; and from the known action of heat on water, can in these circumstances give rise to no current motion, but only to evaporation. The distribution of heat throughout the ocean, and its effects, are also well known, and are equally conclusive against the alleged under-currents in the ocean. These two reasons ought of themselves to be perfectly sufficient to prove that no oceanic under-currents exists; but when they are coupled with all the other facts and arguments adduced in disproof of such currents, they ought, it is submitted, to be perfectly irresistible to every truly scientific mind.

But Captain Selwyn, in support of his views as to under-currents, draws farther upon the imagination, and holds that such currents must exist, because in his opinion "they are necessary to carry material to oceanic animalcular life to construct their shells." This notion is also promulgated by Captain Maury; who also contends that the Red Sea and Mediterranean would have been choked up with salt, especially the former, did under-currents not flow out of them—though such under-currents, it must be remarked, have never been seen by anybody, and for the existence of which, it may most safely be said, there is not a particle of truly scientific proof. And it may also be further remarked that nature attains her ends by much easier, simpler, and less cumbrous means than men in general are at first able to appreciate; and that the chemical doctrines of *solution* and *diffusion* afford sufficient insight into a much simpler, a more beautiful, a more efficient means of attaining the ends above-mentioned, so far as necessary, than would a system of under-currents, so cumbrous, and also so wasteful of power as to be impossible; for it may well be asked, Where could the requisite supply of power possibly come from? How could it possibly be generated?

Captain Selwyn alludes, in the course of his remarks, to what he calls the law of motion in water. It is evidently surface motion—waves and currents—caused mainly by currents of air, though also to some extent by the tides, to which he refers. Now the motion of the waves, most formidable looking as it often is, extends after all only a very few feet below the surface. The currents are regulated by the length of time, and the strength with which the wind blows in one direction. In the open ocean the tides produce no currents. The currents in the north part of the North Atlantic, where the Atlantic Cable would be laid, reach only a very few feet below the surface, if, indeed, they ever extend much more anywhere, except, perhaps, in one or two cases.

Captain Selwyn says that if I admit the existence of surface currents, and deny the existence of under-currents, why should I leave the tranquil depths below and take the cable into the troubled waters above? My reply is, that I do not propose to take the cable into the troubled waters above. The troubled waters in the open ocean, as already said, and particularly in the north part of the North Atlantic, extend only a few feet downwards—no further, there is every ground for believing, than 30 or 40 ft.—and, below that, the water is, and the cable and the buoys would be, perfectly still and tranquil; while there would be extremely little pressure on the cable and buoys nature of the bottom would be a matter of no moment whatever; and the cable would be accessible;—all ensuring the success of ocean telegraphy—a success not to be obtained by bottom telegraphy, with its most enormous and constant pressure; the certain unsuitability of the bottom in many places; and the utter inaccessibility of the cable: these immense disadvantages being sure to end in complete failure.

It may be observed that the truth of these views, as to the stillness of the ocean, may so far be very easily put to the test, by direct examination, by means of a diving bell sunk 30 ft. or 40 ft., or farther, below the surface.

It may also be observed that there is much to be done in the way of improving oceanic hydrography in other respects. Many of the views generally entertained in the present day with regard to the Gulf Stream, its course and effects, will yet be regarded with some degree of astonishment.

Edinburgh, May 11, 1863. H. K.

SPRING LOAD FOR SAFETY VALVES.

Sir,—Can you or any of your thousands of my fellow-subscribers give any good reasons why the spring load for safety valves, as used on locomotives, is not adopted in our steam marine, in lieu of the mass of weights which is the present practice? It is difficult to see why a mass of weights dangling inside or outside a boiler is to be preferred to the equally safe and much lighter spring. For, while the pressure of the spring is practically constant, the pressure of the weights, owing, of course, to the vertical action of gravity, is subject to constant and great variations through the working of the ship in a seaway, and these variations are greatest at the very time when steadiness is most required, viz., in bad weather, causing priming and all its attendant evils, of want of water, extra work for the feed-pump or injector, and these too at a time when they, especially the injector, will not work well, being greatly influenced by the same cause; nor must we omit the power of the weights in the ever-varying motions of a ship at sea to destroy the fit of the valve on its seat, causing a loss of steam which, towards the termination of a long voyage, is often considerable. It is well known that in bad weather the boiler is a source of great anxiety to the engineer, often through failure of steadiness causing the loss of a valuable ship and of still more valuable lives. Knowing that any suggestion tending to mitigate these evils will find a corner in your Magazine, I have ventured to address you, wishing to contribute my mite towards getting rid of, to my mind, a monstrous mechanical barbarity.

I remain, &c.,

Millwall, E. Robert Shenton.

Meetings for the Week.

Mon.—*United Service Inst.*—"Steering and Manœuvring Ships with Broadside Batteries by means of Twin Screw Propellers," at 8.30 p.m.

British Architects.—At 8 p.m.

Tues.—*Inst. Civil Engineers.*—I. Discussion upon Mr. Watson's Paper "On the Communication between London and Dublin." II. "On the Manufacture of Duplicate Machines and Engines," by John Fernie, Esq., at 8 p.m.

Royal Inst.—"On Sound," by Prof. Tyndall, at 3 p.m.

Wed.—*Soc. of Arts.*—"On Destructive Distillation, considered in reference to Modern Industrial Arts," by B. H. Paul, Esq., at 8 p.m.

Geological Soc.—I. "Further Observations on the Devonian Plants of Maine, Gaspé, &c.," by Dr. J. W. Dawson. II. "Notice of a new Species of *Dendrerpeton*, &c.," by Dr. J. W. Dawson. III. "On the Upper Old Red Sandstone and Devonian Rocks," by J. W. Salter, Esq. IV. "On the Relations of the Sandstone of Cromarty with Reptilian Footprints," by Dr. G. Gordon and the Rev. J. M. Joass (communicated by Sir R. I. Murchison), at 8 p.m.

Thurs.—*Royal Inst.*—"On Geology," by Prof. Ansted, at 3 p.m.

Antiquaries.—Ballot for the Election of Fellows.

Royal Soc.—At 8.30 p.m.

Chemical.—At 8 p.m.

Fri. — *United Service Inst.*—"The History of the Bayonet," by Capt. Sir S. Scott, at 3 p.m.

Royal Inst.—"On the Sun's Chemical Action," by Prof. H. E. Roscoe, at 8 p.m.

London Inst. —"On Economic Botany," by R. Bentley, Esq., at 7 p.m.

Architectural Assoc.—Class of Design—Metal Finial and Cresting.

Sat. — *Royal Inst.*—"On the Science of Language," by Professor Max Müller, at 3 p.m.

Miscellanea.

Improvements in Railways.—A new economic permanent way, designed by Mr. G. F. Griffin, is attracting attention. The sleepers are made of corrugated cast iron, and the cost per mile is stated at £1,245 against £1,806, or £1,844 under the existing systems. Apart from saving in annual maintenance, Messrs. Brassey, Betts, Trevethick, and others have given very favourable opinions of its qualities, and an experimental portion laid down about fifteen months ago on the Great Northern line is stated to have shown most satisfactory results.

In consequence of the great success which has attended the newly-invented ventilating arrangements on board the iron-clad screw frigate "Royal Oak," 35, Capt. Campbell, fitting for sea at Chatham, the Lords of the Admiralty have decided on introducing a similar system on board the other vessels composing the squadron of armour-plated steamers. Orders have accordingly been received at Chatham dockyard for one of the officials from Devonport dockyard to proceed to Chatham for the purpose of obtaining a knowledge of what has been done, with a view to their being applied to the armour-plated frigate "Ocean," recently launched at Devonport. The system of ventilation carried out in the "Royal Oak" is from a plan submitted to the Admiralty by Capt. Fanshawe, superintendent of Chatham dockyard; the engine-room and stoke-holes being ventilated according to the principles laid down by Mr. Baker, inspector of machinery, and the chief of the engineering department at Chatham.

A newly-invented electro-metallic coating is about to be applied to the plates of the iron-cased steam frigates "Gloire" and "Invincible." It appears that this new composition has been found to be very successful in the preservation of metals. The Minister of Marine has addressed a despatch to the several Port-Admirals instructing them to send a number of shipwrights to Paris to be instructed in the preparation of this new composition. Experiments likewise are about to be made to prevent the rolling of iron-cased ships.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2805.
Boilers and Furnaces, 2808.
Ships and Boats, including their fittings, 2800, 2839, 2841.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2809, 2821, 2825, 2847.
Cultivation of the Soil, including agricultural implements and machines, 2803, 2832, 2843.
Food and Beverages, including apparatus for preparing food for men and animals, 2826.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2810, 2814, 2823, 2824, 2828, 2834, 2844, 2849.
Buildings and Building Materials, 2811, 2829, 2837.
Lighting, Heating, and Ventilating, 2802, 2830, 2842, 2846.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2812, 2822, 2827, 2836, 2840, 2848.
Metals, including apparatus for their manufacture, 2807, 2813, 2831.
Chemistry and Photography, 2820.
Electrical Apparatus, 2845.
Warfare, 2819.
Letter-Press Printing—*none.*
Miscellaneous, 2799, 2801, 2804, 2806, 2815, 2816, 2817, 2818, 2833, 2835, 2838, 2850.

2799. J. and J. Cash. *An improvement in the manufacture of valentines.* Dated October 16, 1862.

This invention consists in manufacturing valentines in silk, or in a combination of silk and cotton, of the various colours required, according to the design or pattern to be produced, in an ordinary ribbon loom. Heretofore valentines have been generally made of paper, and in all cases the design or pattern has been produced by colours applied by printing or by the brush; now highly illuminated valentines will be produced by this invention with the colours for the necessary design woven into and forming part of the fabric composing the valentine. *Patent abandoned.*

2800. J. Robinson. *Improvements in protecting the sub-*

merged portion of iron ships, and in ventilating the cabin and cabin decks in iron ships. Dated October 16, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2801. E. Stely, jun. *Improvements in envelopes.* Dated October 16, 1862.

In carrying out these improvements, the inventor takes any ordinary blank or pattern of envelope having side flaps or lappets, and the top or seal flap and the bottom or pocket flap each so shaped that there is no one flap or folding piece of the same size or shape as the envelope face. He folds and gums the blank in the ordinary way, and along the upper edge of each of the side flaps or lappets, and inside thereof, he lays on a thin slip of gum; he then introduces the second piece of plain or coloured paper, or other material, so as to form a square pocket, this second piece being secured to the under face of the side lappets and the upper point or tongue of the bottom or pocket flap. *Patent abandoned.*

2802. E. Nelson. *Improvements in the manufacture of apparatus for heating and superheating steam and air without decomposition.* Dated October 16, 1862.

This invention consists, principally, in the use of highly refractory materials in such manner as to prevent decomposition, and render the apparatus perfectly air and steam tight. *Patent completed.*

2803. J. Summerton. *Certain improvements in harrows for harrowing land.* Dated October 17, 1862.

This invention consists in forming the principal parts making the harrow or implement of a triangular radial shape, which, by preference, the patentee forms from cast iron, the same having flukes or projections on both sides, the points of which curve forward in the direction of the line of draught, and are larger on one side than the other. These angular pieces are connected by links or rings in the order as to equally distribute the effect of the flukes or projections as the harrow passes over the surface of the ground in the process or operation of harrowing. *Patent completed.*

2804. H. Wickens. *Improvements in machinery for making nails.* (A communication.) Dated October 17, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2805. J. and G. Davies. *Improvements in rotary engines, rotary pumps, and rotary blowing machines.* Dated October 17, 1862.

This invention consists—1, in guiding the sliding pistons by means of projections on their inner ends engaging in grooves in the end plates of the fixed cylinder, against the inner sides of which grooves the said projections bear. As the small cylinder rotates, the sliding pistons are pressed outwards, and made to bear accurately against the fixed cylinder by the inner sides of the grooves acting on the projections on the inner ends of the sliding pistons. The inner or guiding surfaces of the said grooves are nearly, but not quite, circular, being of greatest radius in a plane parallel to that of the spring bearing. Instead of the grooves described, fixed irregular cams on the plates closing the fixed cylinder may be used with like effect. 2. The invention consists in the employment of a self-adjusting packing on that edge of each sliding piston which bears against the fixed cylinder. *Patent completed.*

2806. W. S. Kennedy. *An improved method of, and apparatus for, applying fomentations and other external remedies to the throat.* Dated October 17, 1862.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating thereto cannot at present be seen.

2807. G. T. Bousfield. *Improvements in the manufacture of iron and steel.* (A communication.) Dated October 17, 1863.

In the manufacture of iron and steel by blowing atmospheric air into and through melted cast iron when contained in a suitable vessel, it has been usual to employ several tuyeres at or near the bottom of the vessel containing the melted cast iron. This invention consists in applying a single tuyere at the side of the vessel near the bottom. The form of the tuyere may be varied. By thus using only one tuyere, considerable advantage is derived in this manufacture. *Patent abandoned.*

2808. J. H. Johnson. *Improvements in the prevention or removal of incrustations in or from steam generators.* (A communication.) Dated October 17, 1862.

This invention relates to the use of certain additional ingredients in the manufacture or preparation of the peculiar liquid for preventing and removing incrustation in or from steam generators, for which letters patent for the United Kingdom were granted to the present patentee on the 25th day of January, 1862, (No. 196), and consists in the addition to the ingredients named in the specification of the patent above referred to of one part by weight of tan or powdered oak bark converted to an extract, and reduced to 12 deg. Beaumé, five parts by weight of natural leaves cut into shreds or small fragments, and two parts by weight of animal marrow. The following are the ingredients and proportions now proposed to be employed, and which have given the best results, although the proportions may be varied slightly:—Snail or snug liquor, one hundred parts by weight; carbonate of potash, eight parts by weight; molasses or treacle, two parts by weight; leaves of the aloe, five parts by weight; animal marrow, two parts by weight; extract of tan, 12 Beaumé, one part by weight. These ingredients must be boiled together for about two hours, and then strained off, when the liquor will be ready for use. *Patent completed.*

2809. R. Webster. *Improvements in means or apparatus for preventing or mitigating accidents arising from collisions of railway trains.* Dated October 18, 1862.

This invention consists in the application to each end of railway trains of a fender or projecting guide frame, which is formed with an incline or slope, or at an angle to the rails, in such manner that when two trains come in collision the said fenders or guides of each train will come in contact with each other, and the inclines thereof will cause the trains to be deflected, or guided sideway from the rails, so as to pass each other, and thus avoid direct concussion, which is now the case when two trains come in collision. *Patent abandoned.*

2810. E. Lord. *Certain improvements in machinery for opening and cleansing cotton and other fibrous substances.* Dated October 18, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2811. H. Ledger and B. Williamson. *An improved substitute for tombstones, tablets, monuments, and other similar memorials or commemorative records.* Dated October 18, 1862.

This invention relates to a substitute for tombstones, monuments, tablets, and other similar memorials, and consists in a combination of metal and glass, or other vitreous substance, the body of the record or memorial being constructed of cast or wrought metal, and arranged so as to receive panels of glass bearing an inscription, or lettering, or ornamental designs. These panels are to be secured from the inside, and packed and bedded in any cement, and so arranged that they may be taken out for additional lettering if required. The lettering may be preserved by varnishing or painting the back, and the metallic portion of the structure may be painted in representation of stone, marble, or otherwise, the whole forming a durable and economical substitute for the materials ordinarily employed in such records. The patentees further propose that wood, stone, marble, porcelain, cement, or any plastic materials, may also be employed with glass for such purposes. *Patent completed.*

2812. J. Bentley. *Improvements in apparatus for forming and pressing felt hats.* Dated October 18, 1862.

This invention relates to the apparatus ordinarily used for forming and pressing felt hats, and consists in certain various alterations in the form and arrangement of the said apparatus, and also in certain additions thereto. The first improvement consists in forming the lid or cover of the apparatus with a hinge or joint, on which it turns when lifted off the other part of the apparatus. The second improvement consists in forming the pin of the hinge with a passage through it, which communicates with another tube or passage formed in an arm connected with the lid, and forming part of the hinge. Through these passages the water is supplied to the interior of the apparatus, or discharged from it at pleasure. The third improvement consists in the mode of applying the india-rubber or elastic bag. This the patentee attaches to the under side of the cover by means of a hoop or ring, which is secured to the cover by means of screws. The fourth improvement consists in the mode of securing the cover or lid to the body of the apparatus. This he effects by means of radial bolts, which are acted on by a cam turning on a centre at the middle of the outside of the cover. The fifth improvement consists in forming the basin or mould in two or more separate parts, and at the same time firmly securing the parts together when in use. The sixth improvement consists in the application of a gauge of a peculiar construction for indicating the pressure of the water when the apparatus is in use. This gauge is placed in a conspicuous position, so that the operator can at all times know at what pressure he is working. *Patent completed.*

2813. B. Lauth. *Improvements in machinery or apparatus for polishing sheet iron or other metal.* Dated October 18, 1862.

In carrying this invention into effect the patentee employs three or more rolls, mounted on a suitable frame, and placed one above the other, their axles being horizontal and parallel to each other. He prefers the use of three rolls only, the upper and lower rolls being of equal diameters, and the other or intermediate roll, which works in contact with the other two, being of a smaller diameter. The sheet iron or other metal to be polished is to be passed (either one or more sheets at a time) between these rolls, and their operation will polish the sheets and give them a beautiful lustre. By the employment of three rolls of different diameters arranged in the aforesaid manner, a sufficient pressure can be obtained to lengthen or draw the thinnest sheet iron or other metal, which has been hitherto unattainable by the application of rolls arranged in any other way. By passing two or more sheets at a time through the rolls, the pressure will be augmented, and the amount of work performed will also be proportionally increased. *Patent completed.*

2814. R. A. Brooman. *Improvements in frames for doubling and twisting threads.* (A communication.) Dated October 18, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2815. J. Fuller. *An improvement in treating india rubber used on a wire or wires for insulating the same.* Dated October 18, 1862.

This invention consists in treating india rubber after it has been placed on a wire or wires to insulate the same for electric telegraph purposes by first applying thereon naptha or other solvent water, or other matter that will render the surface of the rubber covering damp or adhesive, then powdering or otherwise applying sulphur, and exposing the rubber so treated to heat in order to "cure" the same. Or before the curing, more india rubber may be applied on the sulphured india rubber, and the "curing" may be effected after the additional india rubber has been applied. *Patent completed.*

2316. W. E. Gedge. *Improved apparatus for extracting condensed steam.* (A communication). Dated October 18, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2817. W. Clark. *Improvements in apparatus for dredging.* (A communication). Dated October 18, 1862.

The object of this invention is to render streams, rivers, or other channels navigable at all times, which otherwise, by reason of the displacement or accumulation of the sand or mud caused by floods, have their channels blocked up by sand banks. The principal features of this invention are—1, That it is self-acting, being actuated by a hydraulic wheel driven by the current. This wheel communicates motion by means of suitable gearing to one or more screws used for raising the sand; and, further, the apparatus only works during the tide. 2, It is only necessary to be about 6 ft. high, and may be kept at the mouths of rivers during bad weather. 3, The various parts of which the apparatus is composed always retain their proper position, therefore the useful effect is always at the maximum. 4, The small size of the driving wheel renders it little liable to damage from the violence of the sea. *Patent completed.*

2818. J. Tangye. *Improvements in or addition to certain kinds of pulleys for raising heavy weights.* Dated October 20, 1862.

This invention relates to pulleys of the kind called differential pulleys—that is, pulleys of the kind described in the specification of letters patent granted to Thomas Aldridge Weston, dated the 25th day of April, 1859 (No. 1033), and consists in the mechanical arrangements hereinafter described, by the use of which the said differential pulleys may be applied to the lifting of heavier weights than they can conveniently be applied to the lifting of as ordinarily constructed. To the axis of the pulley the patentee attaches a toothed wheel, with which toothed wheel a pinion on another and parallel axis engages. The axis of the said pinion carries a ratchet lever or winch with which to turn it; or it is provided with a spocket wheel with an endless band passed over it for the same purpose. By giving a rotary motion to the axis of the pinion, a slow motion is given to the differential pulley. By this invention differential pulleys may be made very powerful, without increasing the size of the pulleys to an inconvenient extent. Although a train of one toothed wheel and a pinion is sufficient for all ordinary purposes, yet multiplying gear, consisting of a longer train of toothed wheels, may be employed where it is desirable. The toothed wheel and pinion may either work within or without the frame carrying the pulley. Where the pulley is small, the toothed wheel may be conveniently made hollow, the pinion taking into teeth on its inner surface. *Patent completed.*

2819. G. Haseltine. *Improvements in forging cannon and other heavy articles.* (A communication). Dated October 20, 1852.

The object of this invention is to make a cannon or other similar and analogous forging, by combining and welding rings or hoops in such a manner that the fibres of the metal will be continuous and concentric with the axis, and the welding of the rings together consolidates the entire mass, without exposing it to the action of the heat, except at the points where the welding is to be effected, and at the time only when it is necessary to heat those parts in preparation for their junction. *Patent completed.*

2820. R. A. Brooman. *Improvements in transferring designs and prints produced by photography to stone or zinc.* (A communication.) Dated October 20, 1862.

This invention consists in reproducing prints produced by photograpy upon lithographic stones, or upon zinc plates. Preference is given, however, to lithographic stones, and the inventor describes the invention as applied to such stones. He takes a lithographic stone and grains it, as for ordinary use. He places it flat upon a table, and throws over its surface a small quantity of a composition of water bichromatized to saturation, and of thick solution of gum arabic mixed in equal proportions, and spreads it equally over the surface of the stone, and rubs with a clean rag to dryness. He takes a transparent positive photograph upon glass, and applies it with the face carrying the impression in contact with the stone, and fixes down the corners of the glass with wax or cement. All this is performed in a dark chamber. In some cases, especially where photographs cannot be readily obtained upon glass, he uses positives on paper. The positive being fixed upon the stone is covered with a black cloth to protect it from light, the stone is then taken to the spot where it is to be exposed, and the cloth is removed. The light should be brilliant or diffused, according to the design on the photograph; brilliant for sharp lines, and diffused for designs possessing delicate half tints. The time of exposure will vary with the light—on a fine day at noon, for example, about one minute will suffice. After the time allowed has elapsed, he covers the stone with the black cloth, and returns it to the table in a dark chamber. He raises the glass or paper with care, and throws on the stone a solution of potass, for the purpose of destroying the coat of bichromatized gum in those parts protected from the action of light, and to form a slight engraving. In about a minute or more he inclines the stone and allows it to drain, then places it flat and passes over it a sponge containing some such fatty matter as soapsuds, which he causes to enter into the engraving produced by the solution of potass. He next wipes the surface with a soft linen or other rag, and when dry, he gums the stone as in the ordinary lithographic process after it has been acidulated. He leaves the stone to rest for about a quarter of an hour, and then inclining it, washes it with plenty of clear water, and allows it to drain. He again gums it and places it on a lithographic press, allows about a quarter of an hour or more to elapse, and then inks the stone and proceeds to print as in the ordinary process. *Patent abandoned.*

2821. J. Clark. *Improvements in the means of applying railway breaks.* Dated October 20, 1862.

This invention relates more particularly to continuous breaks, or that class of breaks in which the break-power is applied to any number of carriages in the same train, either simultaneously or in rapid succession. The patentee proposes to employ ordinary break-blocks of wood or metal suspended from the carriage frame, so as to clip or fit on to the peripheries of the running wheels, and to apply one or two blocks to each wheel, and on one or both sides of the carriage as may be desired. On the lower part of each of these blocks, he mounts a pulley grooved at the periphery to receive a rope or chain, which rope or chain, being passed over or under and round, and partially round the pulleys placed one before and the other behind the carriage wheel, will cause the said blocks, when the said chain or rope is tightened, to grip the said wheels and retard or counteract their rotary motion. Each carriage being fitted with these break blocks, the rope or chain passes along from one end of the train, encircling the pulley or pulleys of each block or blocks, to the other end of the train, where one end of the said chain is attached to, and wounded upon, a winding drum fitted to the engine, tender, or guard's van, as the case may be. This drum may be turned by hand if necessary by fitting suitable gearing thereto, but he proposes to mount it upon a shaft, sling levers (or in-sliding bearers), and on one or both ends of the drum shaft to fit a driving wheel or pulley, to be turned by being brought into contact with the periphery of the engine, tender, or carriage wheels, as the case may be, or into contact with the rails, so as to make the momentum of the train the power for actuating the breaks. The break-power may be thus applied from one or both ends of the train simultaneously. *Patent completed.*

2822. N. R. Hall and M. L. Parnell. *Improvements in the construction of thermometers.* Dated October 20, 1862.

This invention consists in stretching between two fixed pins or stationary points (which said pins or points can be fastened in a wall or elsewhere, or in a portable frame) a suitable length of wire, to which is connected a spring, and is so adjusted that the spring shall be drawn out or wound, which will keep the wire in a strained position; and the changes of temperature causing the wire to expand and contract, the spring will give or take by this arrangement, and form the working part of this thermometer. *Patent completed.*

2823. W. A. Turner and T. T. Coughin. *Improvements in apparatus for measuring cloths and other fabrics, parts of which are also applicable to indicating distances travelled by vehicles.* Dated October 20, 1862.

This apparatus consists of two upright ornamental standards formed by iron strengthened by tie rods. The upper parts of the standards contain bearings in which a metal or wooden roller is set, the axis of which is extended so as to be fitted with a crank handle, and with a small driving pulley. Another similar roller of different diameter is set in bearings working in slots and in the standards above the former roller, on which it rests; this latter is likewise fitted with a pulley, and is enabled to rise and fall in the slots according to the thickness of fabric to be passed between the two in course of measuring. The top of the standards supports a cross-bar, on the centre of which is fixed an indicator, consisting of a circular dial having numbers thereon, indicating yards or metres or other measures, and another series of numbers indicating tens of yards or metres up to any desired number. There are two hands or indicating pointers turning in the centre, one for each series of figures. Behind the dial a series of toothed wheels and pinions are set in bearings, actuating each other after the manner of clockwork, the first wheel receiving motion by means of a worm or endless screw, set on a shaft worked by a pulley at its extremity, the shaft extending from the indicator along the cross-bar, so that its pulley may be exactly vertical above the former pulleys described. Around the driving pulley and the uppermost pulley a vulcanized india-rubber band is to be stretched, so that the goods to be measured pass between the two rollers, turning the same; the indicator will be actuated and correctly register on the dial the quantity of fabric which has been drawn through the apparatus. The lower roller must be so arranged with regard to its circumference as to indicate yards on the dial, but the upper roller must be of such dimensions as to cause the dial to register metres or other required foreign measure; and when such foreign measures are required to be ascertained, the india-rubber band must be detached from the lower roller, and a shorter one, but crossed, may be adjusted so as to be stretched around the pulley of the upper roller and that of the indicator. In front of the apparatus, on the opposite arms of the standards to those which contain the foregoing portions of the machine, a shaft is set in bearings turned by a handle. Upon this shaft the goods may be wound or rolled up as they come through the measuring rollers. When the apparatus is not required to roll goods, but only to measure and examine them, the shaft and handle may be dispensed with, and the machine may only consist of the two rollers set in standards with the indicating apparatus; then, by by turning the handle of the measuring roller, the goods will be passed through the rolls, and may be examined and measured thereby, either for English or foreign measures. The lower portions of the standards serve to contain or support in bearing tightening or friction rollers, over and under which the fabric passes, and whereby a stress is laid upon it, so as to cause it to be tightly rolled up. *Patent completed.*

2824. J. B. Payne. *Improvements in machinery for pinning, twisting, and doubling and laying of hemp, flax, and other fibrous substance.* Dated October 20, 1862.

According to the first improvement the slivers wound on bobbins are placed in separate rotating frames or cages, called "sliver cages," in which are mounted drawing rollers, whereby the sliver is drawn down to the proper size. A proper drag or tension is put upon the sliver by means of a disc or plate, which is, by means of a spring, pressed down on the sliver, and produces a drag thereon as the bobbin is pulled round by the drawing rollers. The sliver cage is rotated at considerable speed by suitable driving gear, and thereby puts a twist into the drawn out sliver, motion being at the same time given to the drawing rollers by means of a screw shaft or other equivalent mechanism, which is by preference driven by a stationary toothed wheel, into which a pinion or one end of the screw shaft gears and works as the sliver cage is rotated. The drawn out sliver, after being twisted into a yarn, passes out of the sliver cage or frame through a central hollow spindle, and is conducted to another rotating apparatus, which the patentee calls a "tension rotating bobbin frame," by which an additional twist is put in the yarn while kept in a state of tension. This tension rotating bobbin frame is arranged to be driven in such manner that the drawn-out and twisted or spun sliver from the sliver cage will receive more or less twist, as may be desired, while under tension, and in this state the yarn will enter a rotating apparatus, which he calls a "hink preventor," and thence the yarn passes to a doubling or laying spindle, constructed according to the product desired, whether twine, line, or rope. The apparatus which he calls a "hink preventor" is, as above stated, placed between the rotating tension bobbin frame and the laying or doubling spindle, and by means of a series of grooved or other rollers holds the yarn so as to prevent twist passing the part held; thence by the rotation of this apparatus additional twist is put into the yarn intermediate between the "hink preventing" apparatus and the laying or doubling spindle, while twist is taken off the yarn intermediate between the apparatus and the "tension bobbin frame." *Patent completed.*

2825. H. L. Emery. *Improvements in endless chain railway horse powers.* Dated October 20, 1862.

This invention relates to that class of power machines in which force is generated by animals travelling on an endless platform, causing the latter to move in an opposite direction. The invention consists chiefly in a peculiar construction and arrangement of the shafts, gears, pulleys, and their fastenings, for the purpose of obtaining different degrees of force and motion without change in the speed or labour of the animals, in the manner of adjusting the tension of the endless platform to accommodate the run and wear of the latter, and in an improved form and combination of different parts to secure cheapness of construction, and economy and efficiency in working the machine. *Patent completed.*

2826. J. H. Johnson. *Improvements in apparatus for boiling liquids and cooking or preparing food; applicable also as a night-light.* Dated October 20, 1862.

According to this invention it is proposed to combine a vessel or receiver for the liquid to be boiled or heated with a lamp or gas jet or jets in such a manner as to allow the chimney of the lamp or gas flame to pass up the centre of the vessel, and be surrounded by the liquid contained therein. *Patent completed.*

2827. W. Butlin. *Improvements in machinery for splitting leather, and also for making usuable leather out of waste pieces, likewise the machinery necessary for the production of the same.* Dated October 21, 1862.

Provisional protection has not been granted for this invention.

2828. W. Tristram. *An improved method of preparing and dressing yarns or threads to be employed as warps.* Dated October 21, 1862.

This invention consists in a novel adaptation and combination of machinery to effect the desired object perfectly and expeditiously. The operation is conducted as follows:—The yarn is first to be bleached in the bundle, then wound, by means of swifts in the warping frame, on to warpers' bobbins, then from the bobbins on to the back beams in the beam warping mill, or employed for beam warping for taped or dressed work. Next, the inventor arranges any number of these back beams in one end of a dressing machine, called a "kreel," and runs the yarn through a weaver's reed on to a weaver's beam at the opposite end of the machine. For dressing the yarn, he employs a circular brush and hot cylinders or chambers in combination with the above-named machinery. *Patent abandoned.*

2829. W. H. Tucker. *Improvements in self-closing apparatus for doors.* Dated October 21, 1862.

This invention consists, primarily, of particular modes of applying weights to doors, so as to make such doors self-closing. To the seat of a frame or case, which the inventor conceals in the floor, or in a recess behind the doorpost, as occasion may require, he firmly fixes an upright screw shaft, having one or more long spiral threads around its circumference, to which shaft he attaches a moveable screw box or nut, so formed externally that it can be either directly or indirectly acted on by a piece connected with the door, so as to be caused to rise upon the shaft, and also formed so that a weight can be connected with or made to form a part of it, and rise with the nut as it is turned upward on the shaft by opening the door in either direction, and carry the nut downward, and, consequently, close the door by its pressure when the door is again released. *Patent abandoned.*

2830. J. Bryam. *Improvements in lamps for the combustion of paraffin, rock oil, or other oils.* Dated October 21, 1862.

This invention relates to the coneless or coverless-burner lamps, or those having no cover over the burners, and the improvements consist in constructing such lamps so as to to be able to regulate the flame or the quantity of light, as may be required, without having to take out the clams or wick holder to adjust the wick for that purpose, and thus avoid the danger of breakage of the glass chimney, or of igniting the oil in the lamp by such operation; also to prevent waste of oil or the surplus oil from the burners from running down outside the lamp. These improvements are effected by dispensing with the clams or wick holder, and by applying an adjusting spindle and pinions to propel the wick up or down the burner, and the inventor provides troughs to receive the surplus oil, and to conduct it back into the lamp. *Patent abandoned.*

2831. S. Whitham and T. Wright. *Improvements in the manufacture of iron and steel, and in the apparatus employed for that purpose.* Dated October 21, 1862.

The patentee claims the application of hollow lining plates to puddling ball and mill furnaces, in such manner as to form chambers around and underneath the hearth, and supplying the same with atmospheric air for the purpose of preserving the hearth from the action of the flame and liquid metal; 2, the means or method of heating atmospheric air and applying it to such furnaces, as described; 3, the application of a current or currents of water to the doors and frames of such furnaces for keeping them cool. *Patent completed.*

2832. C. G. Clarke, jun. *Improvements in garden shears.* Dated October 21, 1862.

The object of these improvements is to collect the cuttings produced in trimming the edges of lawns or grass borders with garden shears. For this purpose the patentee applies to the lower blade of the shears a receiver of metal, or other suitable material, and of form inclining outwards and upwards, so that, whilst it is capable of collecting the cuttings produced by the use of the shears, it may not interfere with their proper action, by which cleanliness, with economy of labour, will be effected. *Patent completed.*

2833. C. Clark. *Improvements in cigar tubes, and in cigar and pipe mouth-pieces.* Dated October 21, 1862.

This invention consists of a hollow mouth-piece, terminating in a small tube perforated longitudinally, pointed and barbed. In using this mouth-piece, the piercer or pointed end is inserted at the end of the cigar, or at the side if necessary. In hollowing the mouth-piece in which the tube or piercer is fixed, the inventor carries the opening of the tube which encircles the piercer, and into which opening the end of the cigar is intended to be partially inserted, of sufficient length from the point of the piercer inwards towards the mouth end, to leave an open space or cavity between the end of the cigar and the junction of the outer or cigar tube and the inner or piercer tube, to intercept the oil of the tobacco secreted by condensation when smoking; by thus making the tube inverted and double, the oil that is collected in the cavity cannot enter into the mouth, or escape until the entire cigar is consumed, or the end removed. To prevent the piercer tube from splitting the cigar, instead of making it terminate in a tapered tube or single piercer, he divides the tube, and points and barbs each half, so that it forms a double-pronged piercer. *Patent abandoned.*

2834. J. T. Cooke. *Improvements in battens for weaving.* Dated October 21, 1862.

This invention was described and illustrated at page 324 No. 227 of the present volume of this journal. *Patent completed.*

2835. R. A. Brooman. *Improvements in water-proofing, and in recovering products employed therein.* (A communication.) Dated October 21, 1862.

This invention consists in rendering materials more or less waterproof, and in recovering the volatile solvents used in the operation in manner hereafter described. The inventor dissolves caoutchouc, gutta percha, resins, or metallic soaps, in bi-sulphide of carbon, ether, or other like volatile solvents, and adds or not sulphur. By the term metallic soap he means that material which is obtained by combining metal dissolved in acid with the fatty matter of soap in solution. He places the solution of any one or more of the substances above-named in a vessel closed air-tight, or nearly so, and after immersing the materials therein he draws them through an air-tight channel into another vessel. He shuts off communication between the two vessels and applies to the second vessel heat, which he prefers to be that derived from hot water, steam, or hot air, to evaporate the bi-sulphide of carbon, or other volatile solvent used; the vapour is received in a pipe or coil, and is condensed by any of the ordinary methods of condensation. The solvent is gathered in its liquid state, and may be used over and over again. *Patent completed.*

2836. G. T. Bousfield. *Improvements in the manufacture of boots and shoes.* (A communication). Dated October 21, 1862.

The patentee claims a boot or shoe having a sole of india rubber secured thereto by means of nails or rivets embedded in the vulcanized rubber, as described. Also a sole of india rubber vulcanized around the heads of the nails, by which it is to be secured to the upper leather and inner sole, as described. He also claims the use of canvas or cloth in combination with the above sole of india rubber, the nails being passed through the canvas and the canvas secured to the rubber, as described. He also claims the mould in which the sole is vulcanized, having cavities or holes for the reception of the nails. *Patent completed.*

2837. J. Duke and J. Clever. *Improvements in the manufacture of cement.* Dated October 21, 1862.

For the purposes of this invention, the patentees first calcine white or blue lias limestone, mountain limestone, or other carbonate of lime, and having slaked the resulting lime they mix it with slate, clay, potters' clay, porcelain clay, fire clay, or other silicates of alumina, and they intimately combine these materials in a finely divided state in a wash mill, with sufficient water to hold them in suspension; the mixture is run into settling pits, and when it has settled the water is run off, and the residuum is dried and burnt until the silica combines with the lime; it is then ground fine, and is fit for use as cement. *Patent completed.*

2838. G. Haseltine. *Improvements in the mode of, and in machinery for, manufacturing nails, brads, and other similar articles.* (A communication). Dated October 21, 1862.

This invention consists in producing simultaneously two nail blanks, brads, or other similar articles by means of a single punch and die, thereby avoiding the necessity of reversing or shifting the plate after it is placed in the machine; in forming the die of two adjustable metal bars, the ends of which form the cutting edges, whereby a saving is effected in the expense; and in combining and arranging different parts to secure simplicity and efficiency, and, consequently, economy in constructing and working the machine. These improvements are more especially applicable to machines designed for manufacturing from plates of metal, the width of which is equal to the required length of the nail blanks or brads. *Patent completed.*

2839. F. Tolhausen. *An improved machine for raising, lowering, removing, and carrying buildings, monuments, and ships or vessels.* (A communication.) Dated October 21, 1862.

This machine consists of a skeleton frame or scaffolding built all round, and underneath the building, ship, or heavy body to be moved. The part of the said frame that is underneath is moveable, and the other part is stationary. The moveable part is fitted with a number of nuts, into which work screws that are driven by double or treble worm and wheel gear, so as to produce the power required for lifting the heavy body by means of the screws aforesaid. The said heavy body is then placed on rollers or castors to be removed to its final place of destination. *Patent abandoned.*

2840. C. Trees and F. C. Belhomme. *Improvements in hats, caps, bonnets, and other coverings for the head.* Dated October 21, 1862.

In carrying out this invention, the patentees form the hats and other like articles for the head of any suitable soft material, such as cloth, silk, plush, felt, stuff, and the like, suitable for the inside lining in combination with a portion of gutta percha, or any other substance of the same nature, or possessing similar properties. These substances—with or without any suitable elastic fabric in combination therewith, or applied thereto—are cut to the required shape or pattern, and placed over a block, and then subjected to the action of heat applied by rollers, irons, steam, cloths, or other suitable means, whereby the said substances are made to adhere together. The parts previously cut to the required shape are then stitched or otherwise secured together by any of the known means now in ordinary use, thus forming a body or foundation for the hat or other article, a little mellow proofing being used, in addition to the substances above mentioned, in such parts as may require it, to aid in giving and retaining the required form preparatory to the first covering operation, in which first covering they use sheet gutta percha, or other substance of a like nature, as before described. The hats, caps, bonnets, or other coverings for the head thus produced may be crumpled up without injury resulting therefrom, as they will, immediately after such crumpling, resume their original form. *Patent completed.*

2841. G. Clark. *Improvements in the construction, protection, and armament of ships, vessels, and floating batteries, some of which improvements are applicable to land batteries and forts.* Dated October 22, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2842. J. Spence. *Improvements in non-conducting compositions for preventing the radiation or transmission of heat or cold, and in coating metallic and other surfaces therewith.* Dated October 22, 1862.

In the non-conducting compositions made according to this invention, the patentee takes argillaceous earth, and grinds it or beats it up and mixes it with water, so as to form a paste. He then mixes oil cake, fish, or train oil, cow hair, carbonaceous matter, and the other materials, as herein mentioned, or their equivalents, for giving consistency, character, or colour, according to the purpose for which the composition is required. The hair is incorporated, and the whole is mixed and compounded until it has obtained the requisite degree of density or consistency. *Patent completed.*

2843. C. Webster. *Improvements in self-acting fountains adapted for garden engines, fire-engines, and for raising and forcing water from mines, wells, and other places.* Dated October 22, 1862.

Provisional protection has not been granted for this invention.

2844. E. Fielding. *Improvements in the manufacture of healds, and in machinery employed therein.* Dated October 22, 1862.

In manufacturing these improved healds, the inventor makes use of heald yarn of the usual description, but the eye of the heald, instead of being formed by looping the yarn, is produced by means of two small rings of metal or other material, which are threaded on the doubled yarns, and placed at the requisite distance apart, so as to leave the eye between them. *Patent abandoned.*

2845. H. Wilde. *Improvements in electro-magnetic telegraphs.* Dated October 22, 1862.

This invention consists in improvements in the transmitting instruments described in the specifications of letters patent granted to the present inventor on the 8th day of April and on the 10th day of August, 1861, and numbered 858 and 1994, respectively. In the specifications of these patents transmitting instruments are shown and described where the armature of a magneto-electric machine is mechanically geared with a radial arm which travels beneath a series of finger keys, any one of which being depressed, arrests the motion of the radial arm, and also the motion of the armature with which it is mechanically connected. In the present improvement the axis on which the armature or armatures are fixed has two different motions given to it simultaneously, in a circular and lateral direction, which two motions are produced by two different forces acting simultaneously in different directions. *Patent abandoned.*

2846. H. H. and J. F. G. Kronischrœder. *Improvements in the manufacture of gas meters, and in the manufacture of sheet metal suitable for gas meters.* Dated October 22, 1862.

In constructing the measuring drum for a gas meter, it is formed of two concentric cylinders, and the annular space between them is divided into a series of similar measuring compartments by partitions formed as hereafter explained. It is preferred that the annular space should be divided into four measuring compartments, but this is not essential. Each partition from the point where it is connected with the inner cylinder proceeds outwards from it in a straight line, and in such a direction that, if prolonged, it would pass through a small portion of the inner cylinder. After proceeding in this direction for about two-thirds of the distance between the point where it starts from and the point in the outer cylinder, which the line if continued would intersect, the partition descends in a straight line until it joins the outer cylinder; this it does at a point near to where a line drawn from the point where the partition is connected to the inner cylinder, and at a tangent to it would cut the outer cylinder. The water line in the meter is somewhat below the upper part of the inner cylinder, and gas is admitted above the water line into the interior of the inner cylinder. There is a passage formed through the inner cylinder into each measuring compartment, and such openings are immediately below the points where the partitions join the inner cylinder. In the outer cylinder there is an outlet passage formed above each partition for the passage of the gas out of the compartments, when the lowest end of the compartment comes above the water line in the meter. Interior of the central cylinder there is applied or formed a float to support or buoy up the measuring drum, but to which separately no claim is made. By a course of experiments, the patentees have found that rolled tinned sheet metal composed of the alloy of copper and tin hereinafter described, is not so prejudicially acted on by gas and moisture as the metals heretofore used. The alloy consists as near as may be of about sixteen parts by weight of copper and one and three quarters of tin. *Patent completed.*

2847. E. W. Hughes. *Improvements in turn-tables and turn-bridges.* Dated October 22, 1862.

For the purposes of this invention, in constructing the fixed circular track on which a turn-table or a turn-bridge is supported and turns, it is formed with a hollow groove, and by preference of an elliptical cross section, which groove is between two circular ridges or rails suitable for the support of wheels, as hereafter mentioned. The under surface of the turn-table or turn-bridge is made with a similar circular groove. In the groove of the fixed circular track is placed a number of spheres, on which the groove of the under side of the turn-table or turn-bridge is supported. In the centre of the fixed circular track is a fixed upright axis, which passes through the centre of the nave or boss of the turn-table or turn-bridge. Small spheres are introduced between the upright axis and the hollow centre of the boss or nave of the turn-table or turn-bridge, and between the circular fixed rack and the turn-table or turn-bridge there is a circular frame, which also turns on the central fixed upright axis. This frame is composed of several radial rods or bars, fixed at their inner ends to a central boss or nave, and at their outer ends they pass through and are affixed in a circular ring, which is of somewhat less diameter than the inner ridge or rail before mentioned of the fixed circular track, and they extend beyond the outer circumference of the fixed circular track. There is one such radial bar or rod in the space between each two of the neighbouring spheres which support the turn-table or turn-bridge. On each of these radial rods or bars are two wheels—one to run on the inner circular ridge or rail, and the other to run on the outer circular ridge or rail of the circular track. These two wheels turn freely and independently of each other, and the circular frame between the fixed circular track and the turn-table or bridge is supported by them. On each of the radial rods or bars is a wheel which turns freely on the rod or bar, and is of a diameter equal to or nearly so with the space between each two neighbouring spheres, so as to touch one or both of the two spheres between which it is placed, and by which it will be turned in an opposite direction to that in which the sphere in contact with it turns when rolling in the groove in the fixed circular track. *Patent abandoned.*

2848. T. Fearn. *Improvements in the manufacture of rods, poles, tubes, and other forms employed in the construction of various articles of furniture and for other similar purposes.* Dated October 22, 1862.

This invention relates more particularly to the manufacture and ornamentation of rods, poles, and tubes, such as are required for cornice poles, for making bedsteads, couches, chairs, and other analogous uses; and it consists in taking a core or base of metal, wood, paper, or other suitable material, either in the form of a tube, or of a solid, and coiling carefully round such core or base a strip or riband of thin metal, such, for instance, as brass or gilding metal. The core or base may be japanned, enamelled, or otherwise decorated before it receives the coil or twist, in which case a portion of the surface of the core may be left exposed, or the core may be left rough, and the strip or riband may be ornamented with an embossed or engraved enrichment, and coiled closely upon the core or base, thus producing a very rich and elaborate appearance at a low cost. *Patent completed.*

2849. T. Greenwood. *Improvements in machinery for preparing to be spun flax, hemp, tow, silk, waste, China grass, and other fibrous substances.* Dated October 22, 1862.

The object of these improvements is to expedite the dressing operation without injury to the material being dressed. This the patentee proposes to effect by applying a variable speed to the comb sheet, and thereby increasing the speed and action of the combs as the dressing proceeds. *Patent completed.*

2850. V. Orlowski. *Improvements in motive power carriages.* Dated October 22, 1862.

This invention consists in certain arrangements of mechanism whereby carriages may be propelled on common roads by manual labour. The inventor proposes to attach to, and fix on the axle of, the driving wheels at the centre thereof a small toothed pinion, into which a longer toothed wheel is made to gear, and which latter wheel is mounted on an axle set in bearings upon a standard in front of the driving seat, the standard being bolted to the framework of the carriage; or he causes the driving axle to be worked by means of an endless chain in lieu of toothed gearing. A winch handle is attached to the axle of the driving toothed wheel, or the wheel over which the endless chain passes, by which means the driver actuates the main driving wheels, and thus causes them to rotate, and thereby propel the carriage. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated Jan. 14, 1863.

116. W. Pidding, Cole-street, Southwark, gentleman. Improvements in the soles and heels of boots and shoes, in stud nails, tips, and toe or other plates used therewith, and in placing and securing them.

Dated Feb. 14, 1863.

373. C. P. Carter, Kennington-hall, Kent, esquire. Improvements in pavements for roads, streets, or ways.

Dated Feb. 26, 1863.

540. A. Capello, currier, 4, Rue du Repentir, Marseilles. An improved method of, and apparatus for, glazing Morocco leather.

Dated March 9, 1863.

655. W. J. Clapp, Nantyglo Iron Works, Monmouth, and N. Coats, Serhowy Iron Works, Monmouth. Improved armour plates for vessels, turrets, targets, forts, and other structures in which armour plates are or may be used.

Dated March 24, 1863.

768. H. Cook, Sunderland-terrace, Westbourne-park, gentleman. Improvements in the arrangement and construction of apparatus for transmitting electric currents and signals for telegraphic purposes.

Dated March 27, 1863.

805. W. Clark, 53, Chancery-lane, engineer. Improvements in winding or copping frames. (A communication).

Dated March 30, 1863.

817. T. Barnes, Earl of Dundonald, 12, Queen's-gate, Hyde-park. Improvements in treating fats and fatty oils and volatile oils or essential oils.

Dated April 1, 1863.

839. W. Clark, 53, Chancery-lane, engineer. Improvements in preventing fermentation in alcoholic and other liquids while drawing them from their containing vessels, and in apparatus for the same. (A communication.)

Dated April 7, 1863.

875. J. Macintyre, Burslem, Stafford, manufacturer. Improvements in the manufacture of knobs and other articles in china and earthenware.

Dated April 9, 1863.

895. F. J. Risse, Carlisle, engineer. An improved haft or handle for holding tools or instruments of various sizes.

901. G. Ferrand, Wooley-bridge, Derby, tin plate worker. Certain improvements in apparatus for supplying oil or other liquid lubricant to frictional surfaces.

Dated April 13, 1863.

930. R. Newton, Leeds, machinist. Improvements in machinery for separating and straightening the fibres of silk waste and other fibrous substances.

Dated April 15, 1863.

945. T. Gray, Lower Mitcham, bleacher. Improvements in preparing and bleaching flax, hemp, and other vegetable fibres, by which a brilliant lustre is imparted to those substances, and the fibres are separated.

Dated April 20, 1863.

984. E. W. Hughes, 28, Great George-street, Westminster, civil engineer. Improvements in turn-tables, turn-bridges, and slips.

Dated April 21, 1863.

986. H. Raften, 5, Barr's-hill-terrace, Coventry, artist. An improved process of obtaining printing surfaces.

Dated April 22, 1863.

1006. G. B. Barber, Park-street Boiler Works, Red Bank, Manchester, boiler maker. Improvements in steam boilers and apparatus connected therewith.

Dated April 24, 1863.

1014. J. Cavanagh, 21, Parron-street, Paddington, Liverpool. An improvement in cricket bats.

1018. J. Sheppard, Canterbury, conveyancers' clerk. Improvements in steam engines.

1022. J. Cornes, Roden-villa, and J. C. Davis, Cranbrook-park, gentleman, Ilford. Improvements in lawn-mowing, rolling, and collecting machines.

1024. J. Thompson, Bilston, manufacturer. Improvements in machinery for punching metals.

1026. J. Hinks, Birmingham, and J. Newman, Birmingham, manufacturers. Improvements in the manufacture of buttons.

Dated April 25, 1863.

1028. C. Pooley, Manchester, cotton spinner. Improvements in certain parts of machinery for preparing and spinning cotton and other fibrous substances.

1030. S. Harrison, York-street, Sheffield, stereotyper, type-founder, printer, and newspaper proprietor. A new and improved mode of manufacturing type for letter-press printing.

1032. T. A. Weston, Birmingham, mechanical engineer, and C. Vivian, Birmingham, machinist. Improvements in pulleys, capstans, and other machines for raising weights and transmitting motive power.

1036. A. Poirrier and C. Chappat Fils, Paris, manufacturers. Improvements in the manufacture of blue and violet colouring matters suitable for dyeing and printing.

1038. C. Beyer, Gorton Foundry, Manchester, engineer. Improvements in safety valves. (A communication.)

1042. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in thrashing machines, part of which improvements are also applicable for hulling, decorticating, cleaning, and polishing grains and seeds. (A communication.)

Dated April 27, 1863.

1048. J. J. Robert, 112, Rue du Temple, Paris, manufacturer of spoons and forks. Improvements in the manufacture of spoons and forks.

1050. M. Valkenhuyzen, Paris, gentleman. A new castor for furniture.

1052. J. Jeffreys, Upper Norwood. Improvements in constructing surface condensers, and apparatus for heating and cooling fluids.

1054. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in twisting and doubling silk, and in frames employed therein. (A communication.)

1056. W. Hudson, Burnley, gentleman, and C. Catlow, overlooker. Improvements in looms for weaving.

1058. H. Beare, Newton Abbot, Devon, agricultural implement maker. Improvements in machines for thrashing out corn from its straw, part of which is applicable for combing the straw.

Dated April 28, 1863.

1060. J. and W. Marris, Great Grimsby. An improved machine for breaking loaf sugar.

1068. G. S. Macdonald, Meard's-street, Soho. Improvements in card cases.

1070. R. Butterworth, Failsworth, mechanic. Certain improvements in carding engines to be employed for carding cotton and other fibrous substances.

1072. G. E. Donisthorpe, Leeds. Improvements in apparatus used when getting coal and other minerals.

1074. S. S. Marling, Stanley-park, Gloucester, woollen cloth manufacturer. Improved machinery for scouring, washing, and cleansing woollen cloths and other fabrics.

Dated April 29, 1863.

1078. W. E. Gedge, 11, Wellington-street, Strand. An improved system of permanent advertisement. (A communication.)

1080. W. Rodger, 9, Shawfield-street, King's-road, Chelsea, Captain in the Royal Navy. Improvements in anchors.

1084. F. Holcroft, Manchester, engineer. Improvements in the construction of pyrometers.

1086. M. Henry, 84, Fleet-street, patent agent. Improvements in apparatus for manufacturing beton and artificial stone, pugging clay, and other similar purposes, and in the production of artificial stone, and artistic, ornamental, and decorative articles, works, and surfaces. (A communication.)

Dated April 30, 1863.

1088. A. H. Rémond, 4, Moorgate-street. An improved process for retaining the aroma of coffee and cocoa.

1092. C. P. Stewart, Atlas Works, Manchester, mechanical engineer, and J. Kershaw, Duke-street, Westminster, civil engineer. Improvements in engines, machinery, and apparatus for obtaining compressed air, and for applying the power thereof in propelling railway and other carriages.

1094. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in rotary engines. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated April 29, 1863.

1076. E. Rowland, Manchester, engineer. Certain improvements in apparatus for weighing solid bodies and for measuring fluids, parts of which improvements are also also applicable to the opening and closing of dampers.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, May 12, 1863.

3489. F. B. Henderson. Watches and other timekeepers.

3489. F. Lorut. Double weft-forks.

7. J. J. Southgate. Fire escapes.

11. J. B. Baker and J. Landon.. Boots, shoes, and other coverings for the feet.

12. W. A. Distin. Pipes.

20. J. E. Downson. Wrought metal piles, columns, and shafts.

21. R. C. Ransome. Reaping machines. (A communication.)

25. W. Philippi. Bearings and axle-boxes for machinery, carriages, and railway rolling stock.

39. D. Nevin and W. Coppin. Clearing and separating the woody parts from the fibrous portion of flax, hemp, or other like material.

44. J. Leigh. Treatment of gas.

47. M. Hodgart. Presses for pressing cotton and other substances. (A communication.)

50. G. Turner. Making leather from waste pieces of common leather.

53. J. Neale. Manufacture of capsules. (A communication.)

59. G. C. Grimes. Apparatus for treating splints.

60. G. A. Huddart. Buttons.

62. G. Dowler. Match boxes.

65. J. H. Johnson. Permanent way of railways. (A communication.)

69. C. Allen. Signalling on railways by detonating or explosive signals.

72. C. Worssam. Lithographic press.

90. F. Fenton. Manufacture of pulp for paper-making and similar purposes.

95. W. Clark. Winding or copping frames. (A communication.)

96. W. Clark. Carding engines. (A communication.)

107. R. A. Brooman. Machinery for lifting bobbins off spindles in spinning machines and in lubricating spindles. (A communication.)

142. D. F. Leblanc. A dioptical metallic level indicator or liquid gauge. (A communication.)

201. W. Clark. Piston valves and other pistons. (A communication.)

226. W. F. Stanley. Mathematical drawing instruments.

250. C. Mace. Steam engines.

276. F. G. Stuber. Air-tight boxes, cases, cupboards, and similar vessels.

535. H. Edmonds. Ventilation of ships and vessels, and apparatus connected therewith.

567. J. Maxfield. Brewing, and in apparatus employed therein.

720. W. C. Wild and J. H. Randel. Inlaying gold and other metals in glass, and in a composition suitable for the manufacture of jewellery and other ornaments, buttons, and other similar articles.

741. G. H. Smith. Sewing machines.

776. J. White. Removal of foulness of ships' bottoms.

785. R. A. Brooman. Manufacture of cords, ropes, and cables, and in machinery employed therein. (A communication.)

833. J. M. Dunlop. Ginning cotton.

886. T. Gray. Preparing and bleaching jute and other vegetable fibres for spinning and other purposes.

914. H. Caudwell. Construction of vessels of war, part of which improvements is applicable to fortifications.

930. R. Newton. Separating and straightening the fibres of silk waste and other fibrous substances.

945. T. Gray. Preparing and bleaching flax, hemp, and other vegetable fibres.

954. J. B. Watts. Steel sword hilts.

984. E. W. Hughes. Turn-tables, turn-bridges, and slips.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 8, 1863.

3017. G. H. Ogston.
3019. W. Simpson.
3027. J. B. Lavoine.
3037. W. Booth, J. Booth, and T. Booth.
3038. W. Palliser.
3039. H. Burridge.
3040. J. J. Parkes.
3041. E. Marriott and S. Holroyd.
3045. W. Dobson.
3048. F. J. Clowes.
3053. A. Twaddell.
3057. J. Slack.
3058. M. Defries.
3063. R. A. Brooman.
3082. J. Wilson.
313. G. Haseltine.

Sealed May 12, 1863.

3068. W. H. Andrew.
3077. A. and H. Illingworth.
3081. W. H. James.
3083. G. Gray.
3084. F. Palmer.
3089. W. Williamson.
3110. C., G., W., and J. Kilner.
3117. G. W. Oldham.
3124. W. Bottomley.
3136. J. Taylor.
3145. W. Clark.
3147. J. Webster.
3150. W. Clark.
3168. T. Fletcher.
3216. J. Irwin.
3249. H. Swan.
3254. G. Lowal.
3294. J. H. Johnson.
3400. A. V. Newton.
63. G. T. Bousfield.
154. G. Haycraft.
282. W. E. Newton.
307. W. G. Valentin and F. Levick.
446. G. T. Bousfield.
479. W. Wood.
512. R. W. Thomson.
529. W. E. Newton.
532. J. Inglis.
569. D. Collinge.
572. J. Penn.
658. J. H. Johnson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1128. J. D. Dougall.
1158. G. Price.
1170. J. Owen and G. Veith.
1182. E. Lord.
1223. S. Holdsworth, J. and W. Henderson, and T. Bagley.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1057. W. Bulmer and I. Sharp.
1088. A. V. Newton.
1102. R. A. Brooman.
1113. B. Beniowski.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending May 9, 1863.

No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.	No.	Pr. s. d.
2662	0 4	2673	0 10	2683	1 2	2693	0 10	2703	0 8	2712	0 4
2663	1 0	2674	0 4	2684	0 4	2694	0 10	2704	0 4	2713	2 0
2664	0 4	2675	0 4	2685	0 4	2695	1 0	2705	0 4	2714	0 10
2665	0 4	2676	0 4	2686	0 10	2696	0 10	2706	0 4	2715	0 4
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2668	0 4	2679	0 4	2689	0 4	2699	0 8	2709	0 4	2718	0 4
2669	0 4	2680	0 10	2690	0 8	2700	1 4	2710	4 6	2719	0 4
2670	0 4	2681	0 8	2691	0 8	2702	0 10	2711	1 8	2720	0 10
2672	1 0	2682	0 4	2692	0 8						

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£ s. d.		£ s. d.	p ct.
IRON:—					
Welsh Bars, in London	per ton	6 10 0	to	6 12 0	2½
Nail Rods	do	7 0 0		7 10 0	
Hoops	do	8 7 0		8 10 0	
Sheets, single	do	9 5 0		9 10 0	
Staffordshire Bars	do	7 10 0		8 0 0	
Bars, in Wales	do	5 10 0		5 17 6	
Rails	do	5 10 0		6 0 0	nett
Foundry Pigs, at Glasg, No 1	do	2 11 0		2 15 0	
Swedish Bars	do	11 10 0		11 15 0	2½
STEEL:—					
Swedish Keg, hammered	do	16 0 0		0 0 0	
Swedish Faggot	do	17 0 0		18 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	do	96 0 0		0 0 0	3
Hammered Bottoms	do	106 0 0		0 0 0	
Flat Bottoms, not Hamrd.	do	101 0 0		0 0 0	
Tough Cake and Ingot	do	89 0 0		0 0 0	
Tile Copper	do	89 0 0		0 0 0	
Best Selected	do	92 0 0		0 0 0	
Compositn. Sheathing Nails	per lb.	0 0 10		0 0 0	
Yel. Metal Sheathing & Rods	do	0 0 8¼		0 0 8½	
Fine Foreign	per ton	94 10 0		95 0 0	
TIN:—					
English Block	per cwt.	5 19 0		0 0 0	2½
do Bar	do	6 0 0		0 0 0	
do Refined	do	6 4 0		0 0 0	
Banca	do	6 8 6		0 0 0	nett
Straits	do	6 3 0		0 0 0	
TIN PLATES:—					
Best Charcoal, I.C.	per box	1 8 6		9 6	
Second Quality	do	1 6 6		1 7 6	
Coke	do	1 2 6		1 4 0	
LEAD:—					
Pig, English	per ton	20 10 0		23 0 0	2½
„ Spanish Soft	do	20 0 0		0 0 0	
Shot, Patent	do	23 10 0		0 0 0	
Sheet	do	21 10 0		0 0 0	
White	do	26 10 0		0 0 0	
SPELTER:—					
On the spot	do	18 0 0		0 0 0	nett
ZINC:—					
English Sheet	do	23 10 0		0 0 0	2½
QUICKSILVER	per btl.	7 0 0		0 0 0	3
REGULUS OF ANTIMONY:—					
French star	per ton	42 0 0		0 0 0	2½

TIMBER, duty 1s. per load, drawback 1s.

	£ s.	£ s.
Teak ... load	£12 0	£13 0
Quebec, red pine	3 10	4 10
„ yellow pine	3 10	4 10
St. John, N.B., yellow	0 0	0 0
Quebec oak, white	5 10	6 10
„ birch	3 10	4 10
„ elm	3 10	5 0
Dantzic oak	3 10	6 10
„ fir	2 10	3 10
Memel fir	3 5	3 10
Riga	3 0	3 5
Swedish	2 10	2 15
Masts, Quebec red pine	5 0	6 0
„ yellow pine	5 0	6 0
Lathwood, Dantzic, fm	5 10	6 10
„ St. Petersburg	8 0	8 10
Deals, perC., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.		
Quebec, white spruce	15 10	18 10
St. John, white spruce	14 0	15 10
Yellow pine, per reduced C.		
Canada, 1st qual.	17 0	18 0
„ 2nd do.	11 0	13 0

	£ s.	£ s.
Archangel, yellow	£13 0	£13 10
St. Petersburgh, yel.	11 10	12 0
Finlan	9 0	10 0
Memel	10 0	15 0
Gothenburg, yellow	10 0	11 0
„ white.	9 0	9 10
Geflo, yellow	10 10	11 10
Soderhamn	9 10	10 10
Christiania, per C., 12ft. by 3 by 9 in.		
Christiania, yellow	21 0	23 0
DeckPlank, Dantzic, per 40 ft. 3 in.	0 14	1 4
PUMICE STONE pr ton	5 10	9 8
OILS, &c.		
Seal, pale ...per tun	48 0	48 10
Sperm body	83 0	83 10
Cod	48 0	0 0
Whale, Sth Sea, pale	45 0	0 0
Olive, Gallipoli	58 0	59 0
Cocoanut, Cochin	51 0	61 10
Palm, fine	37 0	37 10
Linseed	45 0	0 0
Rapeseed, Eng. pale	61 10	0 0
Cottonseed	33 10	41 10

FRENCH & SMITH, Sworn Brokers,

4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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The *Morning Post*, of September 29th, when describing Benson's Great Clock in the Exhibition says: "The large clock in the centre transept, is a fine piece of mechanism, one of the largest chiming." Benson's new show-rooms contain clocks designed by the first artists of the day, and include clocks for the drawing-room, dining-room, bed-room, library, hall, staircase, bracket, carriage, church, turret, railways, warehouse, counting house, with musical, astronomical, and every description of clocks, from the plainest to the highest quality, of which the art is at present capable. Church and turret clocks specially estimated for. Benson's Illustrated Pamphlet on Clocks and Watches (free by post for two stamps) contains a short history of watchmaking, with descriptions and prices. It acts as a guide in the purchase of a clock or watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world, to select a clock. J. W. Benson received a Prize Medal and honourable mention.—33 and 34, Ludgate-hill, London.—Established 1749.—[Advertisement.]

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 22, 1863.

PORTABLE ENGINE PISTONS.

The number of pistons under 2 ft. in diameter daily at work in Great Britain alone must be something enormous. Small stationary engines and locomotives can be counted by thousands; portable engines must be equally numerous; and leaving locomotives to take care of themselves, or rather, to be taken care of by the trustworthy hands in which they are placed, we may well devote a column or two to the consideration of the best piston for our greviously-wronged agricultural engines, which are generally placed under the charge of the most incompetent persons, and not unfrequently overworked to the last degree of endurance.

It is, perhaps, fortunate that the small diameter of the cylinders of these engines prevents the adoption of a very complex description of piston. Thirty or forty inches of area afford little space for any of that complicated paraphernalia which elevates a large piston to the dignity of an expensive machine. For the most part, makers have been contented with very simple forms of piston, which give more or less satisfaction, according to to the design and workmanship. The wisdom of this course is sufficiently evident. Were it otherwise—were complicated forms introduced—they would give rise to nothing but vexation and disappointment, as bad water and constant priming would destroy them in a few months. Agricultural engines are worked on a system peculiarly trying to both piston and cylinder; worked, perhaps, pretty constantly for eight or nine months during the threshing season, most usually with water so foul that priming is unavoidable, the piston becomes filled with dirt and grit, forced under the pressure of the steam into the minutest cranks and crannies, where it remains to rust and corrode every particle of metal with which it remains in contact during the three or four summer months that the engine stands, as completely neglected as though it were a useless piece of lumber which would never be needed again. As no attempt is made to cleanse or dry the cylinder at the termination of the threshing season, irreparable mischief too often ensues. We frequently find the piston rusted fast in the cylinder when the engine is again wanted, rendering a new piston and the reboring of the cylinder matters of absolute necessity; even at the best of times, a complex description of piston would be utterly unsuited to the working conditions of such engines. It may well be imagined, then, that the construction of pistons which will last and give perfect satisfaction is a question of very great importance to portable engine builders.

An attempt to describe, in even general terms, all the varieties of piston, simple and complicated, which have been introduced from time to time, would vastly exceed the limits at our command; we must, therefore, confine ourselves to a few of the most simple, suitable, and generally used.

We need hardly say that the old-fashioned hemp-packed piston has become one of things "that were," although the durability of hemp under very trying circumstances is sufficiently remarkable. We recently saw an old 12-horse power condensing engine taken down; seventeen years had elapsed since it had made its last revolution, yet on an attempt being made to remove the piston of the air pump, it was found quite air tight with the aid of a little water which lay on it; the packing was found on its ultimate removal to consist of a common hemp gasket, nearly sound, although the rod was almost eaten away by rust. The metallic packing of the steam piston, we may remark, was totally worthless from corrosion. We merely give this as an instance of the durability of hemp, without for a moment advocating a return to its use as a piston packing.

A form of piston early adopted in portable engines, consisted of a simple ring of brass, cast-iron, or steel, cut through at one place, in such a manner that no direct joint existed parallel with the piston-rod. This ring was forced against the cylinder by its own elasticity, aided by that of a circular steel spring, coiled up within it. The body of the piston was made in two parts, which, when put together and made fast on the rod by a nut, left a suitable groove between them for the packing ring. This piston was moderately simple, and has done good service; its great defect being wear at the edges of the ring, owing to which in a year or so it becomes too narrow for the groove, and permits the body of the piston to slip within it at each stroke, leading not only to its gradual destruction, but early permitting an excessive leakage between the ring and the body of the piston; two rings of the same kind have been employed in the length of the pistons with no better results. This piston may be daily met with still and, being very cheap, seems likely to hold its place.

The "Swedish" piston has given much satisfaction when employed in locomotives, and would be well worth a trial in portables. It consists of a solid body, in which two grooves, about half-an-inch square in section, are turned; into each groove is sprung a plain cast-iron ring cut straight across at one place, the elasticity of the rings giving all the spring necessary to make the piston tight. It is said to wear very well, but seems to us to be open in some degree to the same objection that applies to the last.

Ramsbottom's piston has lately met with much favour for locomotives. It consists of a solid cast-iron body, into which three square grooves are turned, varying in depth and width with the size of the piston. In ordinary portables these grooves measure about one-fourth of an inch each way; into these are sprung square wire rings, made of mild steel, of such a size that they fit the groove loosely, making a tight piston by their own elasticity. However well these pistons answer in locomotives, where the rings are much stronger, and are frequently examined and replaced by skilled hands, they are quite unsuitable for agricultural engines, being subject to rapid wear from the very small rubbing surface they offer to the cylinder. We have seen a set worn out in less than a month; they seldom last two; and in addition, are very liable to turn round on the piston, so that one end sometimes springs into the port, invariably breaking the piston as a result. It has been urged that the nominal cost of these rings, and the ease with which they can be replaced, constitute important advantages. All this we admit, when the engine is placed in skilful hands; but we have never met with an agricultural labourer who was competent to the task; the agricultural labourer and the agricultural engine invariably go together, and as these engines frequently find their way into remote districts, the inconvenience and expense of sending for a properly qualified person is sufficiently obvious to prevent their general adoption. Besides, these rings are very apt to set fast in the piston if bad oil is admitted to the cylinder; in which case, of course, the piston becomes a mere solid block; *apropos* of which we may mention that a solid piston was introduced a few years ago, constructed on the following principles:—The inside of the cylinder is very accurately bored, and the piston turned so as to be a very accurate fit; a few shallow grooves are then turned in it, in which a little water lodges, and is said to make the piston perfectly tight.

A very excellent piston is made thus:—A body is cast in two parts, turned, and fitted on the rod, so that when secured with a nut and lock-nut, they leave a groove between them; for a 10-inch piston, three-fourths of an inch deep, and two inches wide. A short cylinder of hard, tough, cast iron, of suitable size, is then chucked in a lathe, and has three rings successively cut from it. The external diameter of these rings is about half an inch greater than the bore of the cylinder. Two of them are turned with one straight and one sloping side, so that the cross section resembles a right-angled triangle with part of the apex cut off, the rings being about ⅝ of an inch thick, ¾ of an inch wide, on the outside, and ½ inch wide on the inside. Our readers will understand that these rings are placed in the groove of the piston in such a way that the straight side of each comes against the top and bottom plates respectively of the piston, leaving a space between them ½ an inch wide next the cylinder, and 1 inch wide next the body of the piston. The third packing ring is turned so as exactly to fill this space when put in position between the other two; its cross section being that of an isoceles triangle with the apex cut off, 1 inch wide next the body of the piston, ½ inch wide next the cylinder, and ⅝ of an inch thick; various other relative dimensions may be employed, but these will answer the purpose of illustration. The effect of the arrangement is, that the middle ring presenting but ½ an inch of surface to the cylinder, wears away much faster than the other rings which present ¾ of an inch each, and consequently pressing outwards, forces the other two rings laterally, owing to its wedge shape, against the top and bottom plates of the piston, so as to effectually provide for end, as well as surface wear. We have said that the rings are made larger than the cylinder, and when finished they have just so much cut out of their circumference as will permit the ends just to meet when placed in the cylinder. Their own elasticity is found amply sufficient to press them against the cylinder, so as to be perfectly steam-tight. The middle ring is sometimes made of brass, an unnecessary refinement.

All things considered, we do not believe a better packing for pistons up to 30 in. diameter can be adopted. From the strength of the rings, it is almost impossible to set them fast; indeed, it is difficult to see how any foreign substance can force its way between them. Once ground slightly together, they always remain in steam-tight contact until completely worn out. The piston is cheap, strong, durable, and unpatented. Indeed we believe it to be a very old invention. It deserves far more general adoption than it has hitherto met with.

Proprietors of portable engines would do well to remove the back lid, and thoroughly coat the inside of the cylinder with good tallow while it is yet warm, if there is any chance of the engine standing idle for a few months. The increased durability of the piston will well repay the extra trouble. Where the engine-driver is intelligent, he might soon learn to remove the piston and clean and oil it from time to time, thus preventing much of the mischief and expense too often incurred by want of care and attention on his part.

INDICATOR CONSTRUCTION.

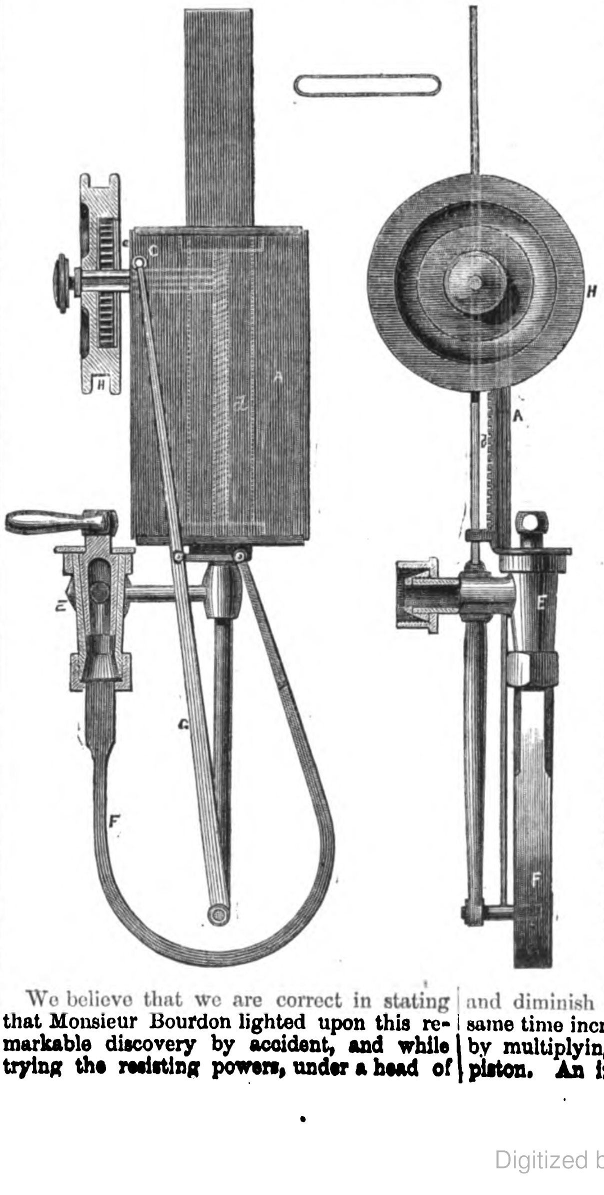
The indicator is an instrument of such importance to the steam-engine, that an improvement on it is almost equal in importance to an improvement on the steam-engine itself. At the death of Watt the use of the indicator declined for some years in England; this instrument was not generally known of, or if known, not appreciated by the other makers, and, as a natural result, the engines from the Soho Foundry still kept up their relative superiority. Indeed, it may be stated that the use of the indicator seems to have progressed in a parallel line with the improvement in the economy of the steam-engine itself. We look forward to great economical improvements in engines working at high pressures and speeds, coincident with the general adoption of an indicator that will register, with complete truth and accuracy, the action of the steam in the cylinders of this class of steam-engines.

At page 481 of Mr. Farey's old but still valuable book on the Steam-engine, will be found a short account of the progressive development of the indicator. The first indicators made by Watt could not take regular diagrams, being made without a pencil and paper to register the action of the steam at different parts of the stroke. This instrument was then merely a kind of combined steam and vacuum gauge; and the performance of the engine had to be roughly ascertained by a practised eye following the up-and-down motion of the pointer along the index. Mr. Farey states that he was unable to learn who first traced a *card* by means of the indicator, and in Watt's short description of the indicator in his Appendix to Dr. Robison's article "Steam-Engine," Watt makes no mention of the diagram. The first application of the pencil to trace a curve was, however, made at Soho; and it is conjectured by either Mr. Southern or Mr. Creighton, the well-known assistants of Watt. At first, the card was fixed flat against a small moveable tablet, placed vertically in a grooved frame. The tablet was moved to and fro at right angles to the motion of the piston rod of the indicator, by means of a string connected to the engine. Mr. Farey's work on the Steam-engine was first published in 1827; and he makes no mention therein of the revolving drum as at present used for the indicator, and so we may conclude that this improvement has an ulterior date to 1827. Mr. Farey advises a size of indicator with a piston 1.95 diameter, thus giving 3 square inches area. He regrets that, at the time he wrote, the indicator was neglected by the engine-makers of the day. Even up to 1838, the steam-engine indicator was but comparatively little known. In the Mechanics' Magazine, Vol. 28, for 1838, will be found an abstract of a paper by Mr. Henwood, giving an account, as a novelty, of an indicator used in Cornwall to get at the duty of the pumping engines in that county.

The two forms of the indicator most generally used in England, are those known under the respective names of M'Naught and Hopkinson. In the M'Naught indicator the barrel for the paper revolves on a bracket fixed to one side of the instrument. This indicator is thus more convenient to handle; but it is alleged that "it is not sensitive enough to show the true action of the steam upon the piston of the engine, because the pencil-holder, with the pencil in the position described, acts as a lever with a motion opposed to the motion of the piston, and adds additional friction." On the other hand, the moving parts of Mr. M'Naught's indicators are made as light as possible, in order to diminish any injurious action on the diagram of quickly reciprocating parts. The revolving barrel for the paper is placed outside the cylinder of the Hopkinson indicator. It will thus be seen that there is little difference in general construction between the M'Naught and Hopkinson indicators. The only differences that really give the relative value of the two instruments as compared with each other, would be the quality of the workmanship and materials, the greater or less weight of the working parts, and the more or less accurate way in which the degrees of the scale are obtained, &c.

Mons. Bourdon, of Paris, whose steam-gauge is so extensively introduced, and whose stand in the Western Annexe of the International Exhibition, offered quite "a carnival" of ingenuity, manufactures a peculiar kind of indicator, the motive principle of which is the the same as that in his steam-gauges. As is well known, he uses a tube, the transverse section of which is of an elliptical shape, or, in fact, of any other form but that of a circle, and the tube is itself bent, generally into the shape of a horse-shoe. The effect of the internal pressure causes the elastic tube to approach to the circular form of section, and this action has a tendency to straighten a bent tube; or, *vice versa*, to bend an irregularly shaped but straight tube.

BOURDON'S INDICATOR.



We believe that we are correct in stating that Monsieur Bourdon lighted upon this remarkable discovery by accident, and while trying the resisting powers, under a head of water, of some leaden pipes. Monsieur Bourdon has even used one of these flattened tubes to drive a small crank and fly-wheel, the return stroke being effected by the bending back of the elastic flattened tube on the steam being withdrawn. The accompanying cut shows his peculiar indicator, in front and side elevation. The stopcock E is in communication with the cylinder of the engine being indicated, and the steam thus enters into the bent flattened tube F; the other end of which is connected to the long arm G, turning on a pin below, and carrying the pencil *c* at the top. The pencil thus moves in an arc, and it leaves its mark on the paper fixed on the flat plate A. Behind this plate a rack *d* is worked by a small pinion. A wheel *e* and a pulley H are fixed on the axis of the latter, and a string is wound on the pulley H to get the progressive motion from the engine by moving the plate A up and down. The section of the pipe is shown on an enlarged scale, at the top of the engraving. This indicator, however, is accused of a want of sensitiveness; the spring is said to require time to follow up the action of the steam; some appearances thus pass unregistered, and these difficulties, of course, increase in proportion to the speed of the steam-engine piston. It is just possible, however, that the difficulty might be got over by increasing the size of the tube. We have not seen any indicator of this description at work in England.

It is evident by the engraving that the scheme is in several respects very incompletely carried out. Thus, it will be seen that the pointer moves in the arc of a circle; which could be avoided by means of a parallel motion. A revolving drum could then be used. All this is said upon the assumption that the sensitiveness required in an indicator could be obtained from this kind of tubular spring; a fact, however, that could easily be ascertained by examining the behaviour of the ordinary Bourdon steam-gauge under sudden alterations of steam pressure.

Mr. A. M. Perkins used, for very high pressures, an indicator constructed somewhat like the common instrument as regards its cylinder and piston, but in which the pressures were denoted by means of an index moving round a divided dial plate, like a spring balance.

Ever since the more general introduction of engines at high speeds, the want has been felt for an efficient indicator for this class of engine. Especially in engines with a rapid stroke, the oscillations of the spring caused by the sudden influx of the steam have proved a serious obstacle to the attainment of exact experimental data. This has been more particularly the case with locomotive engines, working at, say 220 revolutions per minute, with, perhaps, 100 lb. or 150 lb. pressure of steam on the pistons. The obvious remedy would be to increase the stiffness of the spring and diminish the range of the piston, at the same time increasing the scale of the diagram, by multiplying the stroke of the indicator piston. An instrument on this principle was designed some years ago by Mr. Gooch, and was employed by him in conducting the experiments in train resistances upon the Bristol and Exeter Railway. A fully illustrated account of this indicator will be found in Mr. D. K. Clarke's work on Railway Machinery. It may be briefly described as consisting of a small cylinder pressed down by a double elliptic spring; the short stroke of the piston being magnified by a lever. The pencil thus moves in the arc of a circle, which is an objection, as these arcs have afterwards to be reduced to straight lines. A continuous web is driven by clockwork, in order to take the pencil lines. There thus exists the danger of irregularity, incidental to all such contrivances; while there is no absolute certainty that the paper always coincides with the motion of the engine. A continuous web of diagrams is obtained; but the complication of the contrivance itself, and the trouble and loss of time incidental to reducing the diagrams, would always preclude a general introduction of this instrument.

An indicator that has lately been attracting great attention is one known under the name of the Richards' Indicator. It will be found fully described and illustrated in our Number for January 2nd, page 10. It is an American invention, and has been patented in this country by Mr. C. T. Porter.

It may be stated that the Richards' indicator is a much-improved and much-simplified form of Gooch's indicator; it is constructed upon the same leading principle—viz., that of obtaining a diagram on a large scale with a small stroke of piston, that the momentum of the spring and the moving parts may not exercise its necessarily injurious influence on diagrams that have to be taken at high speeds. It will be seen that the pencil is made to move in a straight line by means of a simple parallel motion; there is thus very little additional complication added to the common indicator, as the ordinary revolving drum is used. By the diminished throw of the piston (one-fourth that of the pencil), the friction is much lessened; while the short, stiff spring is not liable to rub against the sides of the cylinder. The piston of the Richards' indicator has an area equal to one half of a square inch. The different springs for the different pressures are easily taken in and out of the instrument, and the diagrams are 3½ in. by 5 in., and they are drawn on metallic paper by a metallic pencil. It appears to us that this indicator is not merely the only practical instrument for high speeds, but is also better than the ordinary indicator for slow-speed engines; though, of course, in this latter case, its advantages may not be so peculiarly felt. We understand that the Messrs. Elliot, the well-known instrument makers, are manufacturing these indicators on an extensive scale. We have previously alluded to the necessity of testing indicator springs while under the influence of heat. The Messrs. Elliot have, for instance, lately found that steam at 86 lb. pressure lessens the stiffness of Richards' indicator spring to the amount of no less than 2½ lb. The annexed diagrams will speak for themselves. They were taken by the Richards' indicator on the 22nd of last April, from the locomotive "Eagle," on the London and South-Western Railway, and we are permitted to engrave them by the courtesy of Mr. Beattie. The diagram shown by fig. 1 was taken with the reversing handle on the first notch, the steam being at 114 lb. pressure, and the locomotive working slowly ahead. Diagram, fig. 2, was taken also on the first notch, but the engines were working at the rate of 260 evolutions, while the steam pressure was equal to 105 lb. on the square inch.

Continuous indicators, or instruments that not merely ascertain but also register the work done by an engine, have at various times been introduced to the engineering public. An efficient and simple instrument of this kind would be of the utmost value, but we do not know of any one that has achieved more than a temporary success. The complication of these instruments, and the resulting trouble in their use, have prevented a general adoption of this description of registering apparatus.

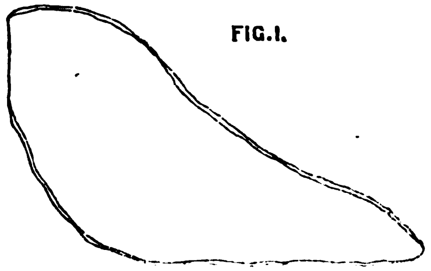


FIG. I.

Half size, twice over.

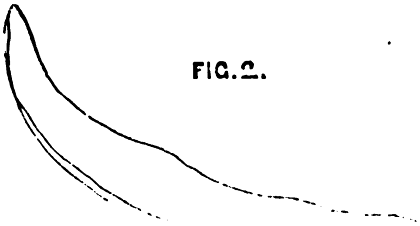


FIG. 2.

Half size, twice over.

A report of a Paper read by Professor Moseley, March 22, 1842, before the Institution of Civil Engineers, on the results of a trial of his Constant Indicator, is given in the MECHANICS' MAGAZINE of 1842, Vol. 37, page 35. This instrument, though highly ingenious, was a failure through its complicated arrangement. We will transcribe the following interesting remarks on indicators generally, made by Professor Moseley in the course of his lecture:—"The indicators originally used by Boulton and Watt were of a large size, with a long and powerful spring curled into a cylindric form, as large in diameter as could be included in the cylinder of the indicator, and the motion allowed to the piston by the spring was very short; such indicators were judiciously proportioned, and they do not show any sensible inequality of division in their scales. But, recently, indicators have been frequently made without the knowledge of their true principle, and the rules of proportion are not observed; so that it will sometimes be found, on actual trial of such instruments with weights, that their scale of pounds per square inch is not in equal divisions, although it is usual to employ a scale of equal divisions for running up the curves traced by them. In Boulton and Watt's indicators the scale of pounds per square inch was formed from actual trial with weights; but such trials were made when the indicator was cold, and dismounted from its place upon the steam-engine. A much better mode is to apply the weights in the upper end of the piston rod when the indicator is placed on the cylinder of the engine, while it is hot, its piston being supplied with the same quantity of oil, and the spring being in the same state as when it is in use. The depression of the piston by the weights is marked by drawing a line with the pencil of the instrument on the card itself, in the same manner as the usual atmospheric line is drawn thereon. A series of lines thus drawn with given weights, become so many original stages for subdividing between them, to form a true scale for running up the curve described under the same circumstances, and nearly at the same time."

About twenty years ago a grant of £100 was made by the British Association for the construction of a locomotive indicator, upon the principle of Professor Moseley's constant indicators, but we do not know with what result. Dr. Lardner once brought a peculiar continuous indicator under the notice of the British Association. Pencils of different colours were acted upon by floats placed in syphon tubes of mercury connected to the steam pipes, condenser, &c., and an endless web of paper took off the impressions of the different pencils. This instrument has also been abandoned.

While upon the subject of indicators, we may allude to a small instrument, which, we think, might be very useful to those having ofteh to calculate from indicator diagrams. After one of the meetings of the Institution of Civil Engineers, in March, 1853, Mr. Hulford, of H.M.'s Dockyard, Woolwich, exhibited a simple instrument of his invention, for ascertaining from an indicator card, the gross steam pressure on the piston. We are surprised that this simple contrivance is not more generally adopted. The following is its description as given in the Transactions of the Institution:—"The indicator card being placed on the board, so that the atmospheric line coincided with the marks on the returning figure, and the side roller made to revolve, until the spiral line on it intersected the edge of the scale, in which position the roller was fixed. The distances between the steam and vacuum lines were taken, by sliding the scale along the figure, and ten or twenty divisions might be taken, according to the degree of accuracy required; the sum of the distances, divided by their number, gave the mean pressure on the piston.

H.

THE QUALITATIVE RETROGRESSION OF THE IRON MANUFACTURE.

THE general depreciation in the quality of iron is getting a serious question. Numerous accidents by sea and land are ascribed by the papers to bad and untrustworthy iron. The nearest ironmonger's shop will tell a similar tale. The African explorers, Dr. Livingstone and Mr. Du Chaillu, tell us that the negroes of the interior of Africa reject, with a grin of contempt, any European iron that is offered to them, preferring their own excellent material, produced direct from the ore, and without any flux, by means of a rough apology for bellows, and worked out by a rude hammer of stone. The fuel used by the negroes is charcoal, and the iron thus smelted is preferred by them to the iron produced by all the appliances of civilization. In the pride of our superior knowledge and power, we often contrast the present state of the arts with that existing in the times of our remote ancestors. As regards quantity of production, we are immeasurably ahead; not so much, however, when quality of produce is taken into account. An excellent figurative contrast between the iron making of the middle ages and of modern times is afforded by a comparison of the "armour platings" of the two periods. It will be an amplification of a sentence in the Inaugural Address to the Institution of Civil Engineers, delivered by Mr. Hawkshaw, January, 1862, in which he says, in reference to our own times, that they form "a new era and another age, when ships, like knights of old, are to go forth to battle in complete armour, and when the civil engineer has assumed the duties which devolved on the smith and armourer of former times." The antique armour, still extant in our museums, shows a skill in the working of iron and steel that has been unsurpassed, even in these latter times of the division of labour principle. The quality of the metal employed is very fine, and shows great toughness and malleability. These armour plates are also often inlayed with gold or silver, in exquisitely designed patterns, and the lines in these patterns were sometimes fitted up in a peculiar way, with a dark composition. *Our* armour plates are on a greater scale; enormous slabs, like the one lately rolled out at Sheffield in presence of the Lords of the Admiralty; but the structure is scarcely homogeneous, and the quality lags far behind the exquisitely tough charcoal iron of the Middle Ages.

In attempting an investigation into the *ultimate* causes that affect the quality of iron, and confining ourselves to cast iron more especially, we are struck by the want of definite knowledge of experienced practitioners and writers on the subject. We mean by *ultimate* causes the influences that are strictly independent of profit and loss in the manufacture, such as the chemical constitution of the iron and the molecular structure involved therein.

The low quality of iron is ascribed by many to the use of mineral fuel in its production; this is, in fact, the most popular and generally received opinion. Undoubtedly the Swedish iron, produced from a very pure ore (the magnetic oxide of iron), and smelted with charcoal only, is the purest iron in the world. Like the charcoal iron of Styria, its production is limited, as the ironmasters are only allowed to burn a certain quantity of trees per annum. The charcoal iron of Nova Scotia does not lie under such restrictions, but in course of time the destruction of the wood forests will sooner or later set very limited bounds to its production. The results of the smelting and puddling operations, and the consequent purity of the iron, of course intimately depend upon the fuel employed, both as regards its chemical constituents and its powers as a combustible. What may be termed the vegetable fuels, charcoal and peat, are the freest from the mineral substances, such as sulphur, phosphorus, silica, &c., the union of which with iron is thought to exercise a more or less deleterious influence on its strength. The heating powers of charcoal and peat are only slightly inferior to the best kinds of mineral fuel, such as the Durham and anthracite coals. Attempts have been made by ourselves, while on the Continent some years ago, to utilize the lignite coal (called Braunkohle by the Germans) for working iron. This coal can be converted into a kind of charcoal in the same way as wood; unfortunately, the blocks of coal crumble to pieces under the process; and although such small pieces may be used for forging iron, it would be impossible to use fuel in a minute state of subdivision for the blast furnace. We have heard that similar attempts have been lately made with the lignite that is found at Bovey Hatfield, near Exeter. We consider that certain means might be easily adopted to overcome the difficulty of the coal crumbling to pieces while being coked. A successful solution of this problem would be of immense value in such countries as Austria and Prussia, where lignite coal is the principal fuel, and the only one in sufficient quantity to utilize the large deposits of iron ore to be found in those districts.

As we stated above, the great value of vegetable fuels in smelting iron, has been ascribed to their comparative freedom from mineral substances. Sulphur is, however, often present in the ashes of wood, as well as in many of the limestones used as flux. Besides, the well-known chemists Berthier, Janoyer, and others have shown that the quantity of sulphur in finished iron is not always in proportion to the sulphur combined with fuel and flux, but rather depends upon the mode of manufacture; such as the proportion of lime in the flux, the temperature of the furnace, the relative proportions of the charge, and other conditions. The precise deterioration caused by the presence of foreign mineral substances in iron, is still a matter of uncertainty, and it has even been stated that the Swedes throw pyrites (sulphuret of iron) into the furnace in order to produce a fine, gray, mottled iron for gun-founding. M. Janoyer's "Annales des Mines," 4 ser., t. xx., p. 359, has shown that sulphur and carbon combine in the blast-furnace, forming sulphuret of carbon, which becomes volatilized. This is the explanation that many of our English "makes" of iron are freed from any sensible traces of sulphur by means of properly working the furnace; although, as it is well known, most British coals contain sulphur. There is little doubt that the presence of sulphur has a deteriorating influence on iron. British coals appear to contain from 0·2 per cent to 2 per cent. of sulphur. As the result of a lengthened experience, Mr. Truran considered that iron was always more or less injured by the presence of any foreign substance. "The presence of carbon, by lowering the temperature of fusion, increases the fluidity of cast metal; but the qualities of hardness and tenacity are reduced in nearly the same ratio. Silver, in quantity, seems to impart additional hardness, but is attended with an equally great deficiency of tenacity, and materially impairs the ability of the metal to withstand crushing and abrading forces." The efficacy of improving iron by the addition of wrought-iron scraps to cast-iron in the cupolas is not denied by Mr. Truran; but he limits its employment to cast-iron of a low specific gravity. He states, "Iron possesses the greatest density and tenacity when pure; the presence of any other metal or matter, or mixture or alloy, reduces its density and diminishes in a more rapid ratio its tensile strength. The crude iron of commerce ordinarily contains about 80 per cent. by volume of metallic iron and 20 per cent. of impurity, is uniformly specifically lighter than pure iron, and possesses a very low degree of tensile strength. "The extent to which this property is deteriorated by the quality and volume of the alloy is a subject of paramount importance to the manufacturer and consumer of iron, but one in which, hitherto, owing to its costliness and extreme delicacy of manipulation demanded in the inquiry, no adequate experiments have been made. By a limited series, we ascertained that the tenacity in the various stages of manufacture was nearly in the ratio of the tenth power of its specific gravity." The superior tenacity of some of the foreign irons has been ascribed to charcoal, their purity, and freedom from admixture with foreign matters. Nevertheless, that the use of charcoal does not always denote great strength may be evidenced by some experiments conducted by the late Mr. Tierney Clarke, C.E., on the strength of Hungarian and Austrian charcoal cast irons. Mr. Clarke proposed to subject these irons to a transverse strain, in the construction of his beautiful bridge over the Danube at Pesth, the Hungarian capital. A general average of five different Hungarian and Austrian charcoal irons gave only 785·253 lb. to bars 1 in. square, subjected to a transverse strain, reduced to bars of 3 ft. bearing. The load was in the middle. All the irons were cold blast. Some experiments on English cold blast iron, quoted by Barlow, gave a mean of 844 lb.

There is little doubt that, by the exercise of a proper amount of skill, the degree of quality of our British iron would not lag so much behind the quantity produced. It is stated that the Belgian pig-iron has been greatly improved by washing the coal, so as to oxidize the pyrites, and convert it into copperas, which runs off in solution. This process would probably injure our coal, unless previously coked. At the same time, it appears to us that if the coal were charged into the furnace but a short time after being washed, very little injury would result. Most British coals deteriorate in quality when lying exposed to the air. They lose a considerable amount of their heating power; they disintegrate and crumble to pieces. Within six months' exposure they lose more than one-half of their iron-melting powers. At the same time, the presence of water in the blast furnace has undoubtedly a prejudicial influence on the "make" of iron. It has been calculated that, in ordinary seasons in England, 100 tons of water are discharged per week into the blast furnace through the tuyeres. This amount would considerably exceed the moisture that might remain on the surface of coal after the process of washing.

The most experienced ironmasters believe that the quality of iron is principally dependent on the fuel employed in its reduction. If the coal contains an insufficient quantity of carbon, or a large percentage of sulphur, it is unfit for smelting the superior "makes" of iron. Coking coal necessarily more or less drives off the sulphur; but for the latter to be completely volatilized the temperature of combustion is required, which is only undergone by the coal during its sojourn in the blast furnace. A portion of the carbon of the coke is consumed if the coking process be carried too far, and the result is a coke containing an undue proportion of ash and a diminished quantity of carbon.

The chemical composition, and the preparation of the limestone flux, also exercise considerable influence on the quality of the iron. It often contains sulphur, and always clay, silica, and other earths. It ought always to be broken into small pieces before being filled into the furnace. The best way of treating the limestone is to subject it to calcination, and then to at once convey it from the kiln to the furnace before its strong hygroscopic properties can absorb the moisture from the atmosphere.

We hope to return to this subject; but, in the meantime, we may state our firm conviction, as a result of a careful consideration of the conditions affecting the iron manufacture of Great Britain, that there is no physical reason why the general quality of British iron should be so inferior as it undoubtedly is at present. The use of a pure fuel like charcoal, and of pure ores like those of Sweden and Acadia, undoubtedly facilitate the production of good iron, merely because there is less chance of any want of skill influencing the result. The production of equally good iron by means of our English ores and coal, is simply a question of greater skill. No physical impossibilities intervene in the way of our ironmasters; let them but give as much attention to quality as to quantity, and the produce of our ironworks would be no longer as unsound in its nature as it is huge in its amount.

The quality of iron so intimately depends upon its chemical constituents, and upon its molecular structure, and both of these are themselves so much influenced by the mode of manufacture, that the exact relative bearings of all these influences will be difficult to ascertain. On examining a piece of iron which has given a certain definite result as to resistance, we ought to ask several questions—How has it been manufactured, and from what ores, flux, and fuel? What is its molecular structure? What are its chemical constituents? Only a practical iron-maker, and a thorough chemist, could answer such questions propounded by an engineer or user of the material. It appears to us that the important inquiries involved in the make and use of iron can only be solved by a scientific commission composed of engineers, chemists, and manufacturers; of those who most largely use and of those who manufacture iron. At present we have only the records of the disconnected experiments of a few individuals, often eminent men, it is true, but necessarily limited in their endeavours by the means and the science at the command of a single individual. "Non omnia possumus omnes."

INSTITUTION OF CIVIL ENGINEERS.

At the meeting of the Institution of Civil Engineers on May 12th, John Hawkshaw, Esq., president, in the chair, the Paper read was "On the Communication between London and Dublin," by Mr. W. Watson, M.A., Assoc. Inst. C.E.

Holyhead, the nearest point of land in Great Britain to the metropolis of Ireland, was naturally thought of at an early date as a convenient port of departure and arrival for the mails. This route had accordingly been used for a century and a half, and was recognized in an Act of Parliament passed in 1729; but the communication between London and Dublin was then irregular, and the time occupied on the journey protracted. Travelling through North Wales was attended with difficulty and fatigue, and the passage of the Channel was contingent on the state of the weather. Though measures of improvement were proposed before the close of the last century, no effectual steps were adopted, until after the legislative union had taken place between Great Britain and Ireland, in the year 1801. Then public commissioners were constantly engaged in inquiries, and committees of the House of Commons presented no less than twenty-five reports on the subject within ten years. These investigations had reference, principally, to the land part of the journey; and by means of large grants of public money, amounting, it was believed, to nearly one million sterling, in 1826 a continuous and easy road was completed between London and Holyhead, so that the entire distance of 267 miles could be performed, with regularity, safety, and comparative comfort, in 34 hours. Improvements for the sea-part of the journey also engaged some degree of attention; but while sailing vessels were in use, it was not thought that much could be gained in the passage of the Channel. In 1819, a steam vessel was placed on the Holyhead station for the summer and autumn, and soon afterwards the "Royal Sovereign" and the "Meteor" were especially built for the Post-office service, with engines by Messrs. Boulton and Watt, and then the sailing cutters disappeared. The average length of the passages of these two steam vessels, in the first year, between Holyhead and Howth, was 7 hours and 33 minutes; the shortest passage was made in 5 hours and 48 minutes, and the longest was stated to have occupied upwards of 23 hours.

The mail communication between London and Dublin had been thus long maintained exclusively by way of Holyhead; but the rapidly growing importance of Liverpool led to the establishment, in 1826, of a direct postal service between that port and Ireland. Steam vessels had been placed on that station, by private enterprise, as early as 1819, for the conveyance of passengers during the summer months; and in 1823, Mr. C. Wye Williams (Assoc. Inst. C.E.) originated a Company for the maintenance of a regular steam communication throughout the entire year, for the conveyance of passengers and of merchandise. As the railway from London to Liverpool was opened in 1838, that line became for some years the most expeditious route to Dublin, and the mails and passengers nearly deserted Holyhead. Liverpool did not long, however, retain this superiority; for, in 1849, a continuous line of railway was completed between London and Holyhead, by private capital, 23 years after the continuous line of road had been constructed, by direction of the State, and principally by grants of public money. The conveyance of the Irish mails was then transferred from Liverpool to Holyhead, and the large and powerful packets of the Government and of the Company, which had carried the night mail under contract for the previous ten years on the Liverpool line, were appropriated to other duties.

During the time these changes were in progress, the packet service was transferred from Howth to the Asylum Harbour, at Kingstown, which was ultimately connected with Dublin by a railway 6 miles in length. The only link then remaining to complete the communication with Ireland was a superior class of vessels. The Government having decided on building four vessels, each of 700 tons burthen, with engines of 350-horse power, the best result was admitted to have been attained; as the rate of speed of the "Banshee" at the measured mile, was upwards of 18 statute miles an hour, or nearly 4 miles in excess of any previously obtained. After a short trial of this service at heavy cost, the Lords of the Admiralty determined that it should be performed by contract, as had previously been the case on the Liverpool line, and that the average speed should be 12 knots, or nearly 14 statute miles per hour. This service lasted from May, 1850, until October, 1860, and was performed within the stipulated time.

Further improvements being still demanded, a plan was submitted to Government, and a new postal contract was entered into, the main provisions of which were, first, that the entire distance between London and Kingstown, instead of to Dublin, was to be performed in eleven hours, allowing four hours for the sea passage; secondly, that four steam packets should be specially built for the service; thirdly, that express trains should be appropriated exclusively to the Irish traffic; and fourthly, a morning and evening departure from each capital. The vessels referred to were each 2,000 tons burthen, and in their dimensions and general arrangements were nearly identical. Three, the "Connaught," the "Ulster," and the "Munster," were built by Messrs. Laird; and one, the "Leinster," by Mr. Samuda. The ships were of iron, timber having been used only for the decks and cabin fittings. The length of the "Connaught" between the perpendiculars was 334 ft., the beam was 35 ft., and the depth 21 ft. There were nine principal water-tight bulkheads, which not only provided for the safety of the ship in case of accident, but added greatly to the strength. The bulwarks were of iron plates, in continuation of the sides of the vessels, without any break for gangways. Between the paddle-boxes there was an upper deck, which further added to the strength amidships; and on this was placed the wheel and binnacle. The entire of the main deck, from the foremost funnel forward, was covered by a hurricane deck, which had been found of great advantage in throwing off seas in heavy weather. The engines in all the vessels were on the oscillating principle. Those for the "Connaught" and the "Leinster" were made by Messrs. Ravenhill, Salkeld, and Co. The cylinders were 98 in. diameter and 6 ft. 6in. stroke, the air-pumps being 54 in. diameter, with a length of stroke of 2 ft. 6 in. The boilers were multitubular, eight in number, four at each end of the engine-room space, arranged in pairs, with one funnel to each pair. There were five fire grates in each boiler, and the total grate surface was 677 square feet, the heating surface exceeding 19,000 ft. The wheels were 31 ft. in diameter to the outside of the floats, which were feathering, fourteen in number, and each was 12 ft. long by 4 ft. 4 in. broad. On the trial trips, the engines worked at the rate of 25½ revolutions per minute, with 25 lb. steam. The mean of the runs of the "Leinster," at the measured mile was 20½, and of the "Connaught" 20¾ statute miles per hour. The engines of the "Ulster" and the "Munster" were constructed by Messrs. James Watt and Co. The cylinders were 96 in. in diameter with a length of stroke of 7 ft. The wheels were 33 ft. in diameter. The boilers had each six fire-places, giving an equal extent of grate surface with the other. The heating surface measured 18,033 square feet. These engines were erected on board the vessels in the Liverpool Docks, and from a return of observations made on several trips, there being no measured mile at that port for testing speed, the rate attained appeared to have been 20½ statute miles per hour. One of the principal peculiarities which made these vessels of so unique a class, was the Post-office fitted for sorting letters on the passage, so that the letters were ready for delivery, or to be forwarded to their destination, on the arrival of the vessels, either at Kingstown or at Holyhead. About two hours were thus saved in the transmission of the mail.

The contract with the Postmaster-General had appointed January, 1861, for the commencement of the improved service. But as the vessels were in readiness some months sooner, it was commenced in October, 1860, and had since been continued without interruption. From what had been already stated, it would have been seen, that the difference of speed between the four vessels on the trial trips was inappreciable—a matter of paramount importance to a mail service. Thus, while the shortest passage of the "Connaught" across the Channel occupied 3 hours and 14 minutes, being at the rate of about 20 miles an hour, the shortest passages of the "Leinster," the "Ulster," and the "Munster," were 3 hours and 20 minutes, 3 hours and 18 minutes, and 3 hours and 22 minutes respectively. Their average performance for the two years and five months during which they had been on service, inclusive of the trips made in fogs, gales, &c., was still closer, as

The "Connaught" made 1,064 passages in 3h. 51½ m. on the average.
The "Leinster" made 919 passages in 3 h. 52¼ m. on the average.
The "Ulster" made 925 passages in 3 h. 55 m. on the average.
The "Munster" made 920 passages in 3 h. 58 1-10 m. on the average.

The consumption of coal in the first few months was considerably in excess of the quantity originally estimated. Steam of from 25 lb. to 28 lb. pressure was then used; but satisfactory arrangements had since been made to reduce the consumption, while the additional time occupied on the passage was but a few minutes, and was still within the time alloted to the sea service. The engines in the "Ulster" and the "Munster" had been provided with super-heaters, but experience had not shown any advantage, either as reducing the consumption of coal, or as tending to a superior performance. These vessels had made in the aggregate 1,845 passages, in the average time of 3 hours 56½ minutes, and had consumed 30 tons 7 cwt. of coal as the average of each inclusive of the quantity required for raising steam, which was considerable. The "Leinster" and the "Connaught," without super-heaters, had made 1,983 passages in the average time of 3 hours 52 minutes, and had consumed, inclusive of raising steam, on the average, 30 tons 1 cwt. of coal.

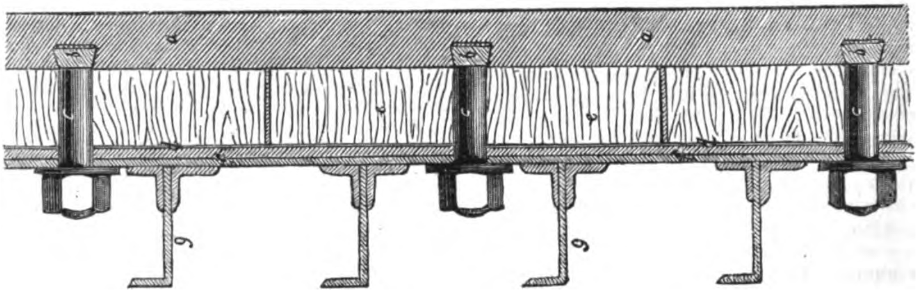
It was satisfactory to be able to state that the ships had, so far, needed no repairs, being now in as perfect a condition as when the service was commenced in 1860. The frequency of docking for the purpose of cleaning and coating, had afforded constant opportunities of examination, when painting only had been required.

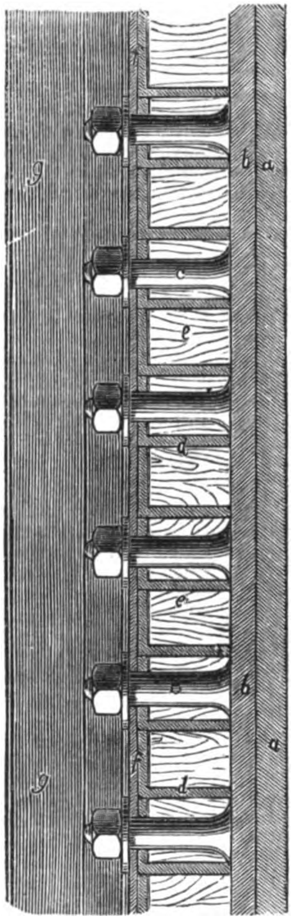
In conclusion, the Author referred to the admirable performance of the land portion of the journey, from London to Holyhead, by the London and North Western Railway Company; the punctuality in the arrival of the trains on the jetty at the latter place, the speed maintained, and the excellence of the carriages, were the subject of universal approval. Further improvements, at present not thought of, might yet be brought into operation; but there appeared to be no reason for apprehending, that the communication by way of Holyhead would ever cease to be the best for postal purposes, and to be preferred by the travelling public, so long as the entire distance between London and Dublin could be accomplished within eleven hours and a half.

IRON CELLULAR BACKING TO ARMOUR PLATES.

MR. GEORGE CLARK'S SYSTEM.

IRON CELLULAR BACKING TO ARMOUR PLATES.





THE trial at Shoeburyness of the experimental target, constructed by the Millwall Iron Works and Shipbuilding Company, on the system of Mr. James Chalmers, has created much interest in the departments which have to determine the best mode of armour-plating our sea and land defences.

Previous to this trial, in accordance with the reports of the special Committee on Iron, and the opinions of eminent scientific men consulted by the Government authorities, wood was considered to be the best material for backing to armour plates. All the iron-clad ships of the Royal Navy, built or under construction, have teak backing, varying in thickness from 18 in. for the "Warrior," to 9 in. for the "Minotaur" class. The principle relied upon was the absorption of the projectile force by elastic resistance spread over a large surface of solid timber. Experiments on targets constructed without wood backing, on plans proposed by the Iron Plate Committee, Mr. Samuda, Mr. Scott Russell, and Mr. Thorneycroft, gave results which were unfavourable to the rigid principle, but in all these cases there was no backing, properly speaking, to the armour plates.

For more than twelve months the defects of wood backing and the probable advantages of a rigid backing have been pointed out in the MECHANICS' MAGAZINE. Our last impression contained a description of Mr. George Clark's system in the form of a report of his observations at a meeting of the Institute of Civil Engineers so far back as February, 1862. Two years ago he submitted his ideas on the defects of elastic and the efficacy of rigid backing to the Admiralty, who, after considerable hesitation, eventually, at the reiterated recommendation of the Iron Plate Committee, on the 31st October last, authorized the construction of a target on Mr. Clark's plan at the public expense.

The Millwall Company, in the first week of November, contracted for the construction of his target. About two months afterwards, at the request of Sir Morton Peto, a partner in the Company, they undertook the construction of Mr. Chalmers' target, which, as our readers know, was completed and experimented upon three weeks ago. Some difference arose between Mr. Clark and the Millwall Company in consequence of the long delay in executing their contract with him; but the target, now nearly completed, is being fixed at Shoeburyness, and will in a few days be put to the usual test under the direction of the Iron Plate Committee.

The approaching experiments, of which the programme will, no doubt, be the same as that for the "Warrior" section, will probably determine the value of rigidity of construction for armour plating.

Mr. Clark is the uncompromising advocate for perfect rigidity. He has been consistently opposed to elasticity in any form, contending that in experimental trials the damage to armour plates and their fastenings was to be attributed chiefly to wood backing and elastic washers. Mr. Chalmers, to a certain extent, has applied Mr. Clark's idea of rigidity by the formation of iron cells at the back of the armour plates; but he, like nearly all the engineers, adheres to the principle of elasticity. To mitigate, or, in his own words, "to guard against the injurious effects of vibration, such as the fracturing of armour plates and the destruction of fastenings and frames of ships which are inseparably connected with very rigid structures," Mr. Chalmers introduces "*a cushion of timber planking*" between the rigid backing and the skin of the ship.

According to Mr. Clark's ideas, this "cushion" is a source of weakness. He contends that, as the wood must be crushed between the two iron surfaces, the cushion breaks the continuity of rigidity in the structure as a whole; and, therefore, the projectile force, meeting with no adequate resistance from the wood, is not "dispersed over an extended area," as it would be if complete rigidity were maintained all over and through the structure.

We give the arguments on both sides. They will soon be tested by the best of all arguments, actual experiment; and we think it creditable to the Government, even at this late hour, that they have determined to submit the rigid system, in opposition to a host of prejudices, to a fair trial. We learn with satisfaction that the Admiralty have agreed to pay the expense of Mr. Chalmers' target. It is, we understand, being dismantled at Shoeburyness, with a view of ascertaining, by an examination of the internal parts of the structure, the effects produced upon it by the severe pounding to which it was subjected.

The above engravings illustrate sections of Mr. Clark's target, showing his system of construction, which comprises not only his plan of rigid backing and back supports, but a mode of dovetailed fastening at the back of the armour plates, avoiding the use of through bolts and perforation of bolt holes in the plates. Serious doubts are entertained by engineers whether the dovetailed slots cut into the plates will not be a greater source of weakness than bolt holes. Mr. Clark's answer is:—1st. That, the heads of the bolts not being exposed to impact, the bolts themselves will not feel the force, and cannot act as wedges to split the plates. 2nd. That distortion causes the fracture of plates; and, as by his plan of complete rigidity and solidity of structure combined, distortion of the plates cannot take place, they will not be more liable to crack at the dovetailed slots than in any other part. Moreover, to obviate this objection, should it exist, some of the plates on his target are formed with ribs, into which the slots are cut, so that the body of these plates will not be diminished in thickness.

The following description of the drawings explains the details of construction:—*a*, *a*, The armour plates; *b*, *b*, dovetailed bars fitted into dovetailed slots cut into the plates; *c*, *c*, armour-plate bolts welded to the dovetailed bars; *d*, *d*, iron longitudinal cells, formed of angle bars, riveted to the skin and frames of the ship; *e*, *e*, filling to the cells, consisting of blocks of teak, with the grain end on, in some of the cells, and of millboard blocks in others, all tightly wedged in; *f*, *f*, skin plate of the ship; *g*, *g*, frames of angle iron, representing the ordinary ribs of an iron ship.

The weight, under the conditions prescribed by the Admiralty, is not to exceed the "Warrior" standard of 346·8 lb. per square foot of superficial area. Additional supports are allowed at the ends and the top and bottom to compensate the want of continuity, and maintain the rigid principle; but within those limits, the weight of every section of the target will be the same as that of the "Warrior."

It will be seen that the system is one of perfect rigidity and cohesion in every part of the structure. In this particular, it differs essentially from the Chalmers' plan, which, as we have shown, is a compromise between rigidity and elasticity. The mode of holding the plates, in the Clark plan, on parallel lines across their width, adds greatly to the adhesive area and screw power of the fastenings. The bolts are of 2½ in. and 3 in. diameter. Those of the "Warrior" are 1½ in. The feature of the plan chiefly relied upon, and of which Mr. Clark claims to be the inventor, is that the iron cells are less in width than the diameter of the projectiles. The area of the target is 13 ft. 6 in. long by 10 ft. in height without a port. The armour plates are seven in number, are of two lengths, 7ft. 6in. and 6 ft., and of three widths, 2 ft., 3 ft., and 4 ft., and they vary in thickness from 3 in. to 4 in., 4½ in., and 5 in., the breadth and depth of the cells increasing with the diminished thickness of the plates. According to Mr. Clark's theory, the real strength of the ship's armour is to be found in the strength and rigidity of the backing rather than in the thickness of the armour plates. He also holds, in opposition to the universal creed, that short plates are, with rigid backing, better calculated to resist projectiles than long ones, as the former admit of being more securely fastened and are less liable to buckle. The cells are 4½ in. and 5½ in. in width, the narrowest and deepest cells being at the back of the thinnest plates.

The experiments on this target, especially after the evidence of the efficacy of rigid backing furnished by Mr. Chalmers' partial mode of its application, will no doubt be regarded with interest.

GREEN AND COCKCROFTS MATERIAL TO BE USED IN LIEU OF PRINTERS' BLANKETS.

Messrs. Green and Cockcroft, of Accrington, propose to form an amalgamation of materials to be used as a substitute for printers' blankets. The material is formed by combining two or more lengths of paper together with a solution of india rubber or its substitutes by spreading it between them and pressing them together. Or a textile fabric may be placed between folds of paper, and treated with a solution as above.

In selecting the "surface" for the article to be used for printers' blankets it must be adapted to the peculiar colours used by the printer, as some colours are strongly acid, some alkaline, and others neutral.

The material is suitable for paper-makers if prepared with a textile fabric at the back; likewise for washers or packing for steam joints—when used for this purpose, any suitable number of any of the above materials are joined together and submitted to pressure and heat or other drying process.

GISBORNE'S ELECTRIC COMPASS.

Mr. Gisborne's electric compass, to which we have before called attention, is nothing more than the ordinary ship's compass, with a battery in the box, and two insulated wires maintaining the electric currents round the needle. This is the whole contrivance. This simple application of electricity supersedes the elaborate inquiries of the Astronomer Royal, the life-long mathematical labours of Mr. Smith, the philosophical observations of Mr. Evans, and the eminently practical experiments of the Liverpool Compass Committee. Hereafter compass variations need not appear in the loss of life and property, and the sailor may range the trackless ocean assured that he steers his course with safe precision. Captain Washington once made the remark that but for the labours of the Compass Committee, Mr. Evans, Mr. Smith, and the Astronomer Royal, it would have been impossible to send iron ships to sea. Mr. Scott Russell, at the same time, while reproaching himself and the shipbuilders of the country with the oversight of the compass, congratulated the officers and seamen of the fleet and the merchant service with the fact that, while he and the shipbuilders were doing their best to advance the science of ship construction to ideal forms, scholars, scientific and practical men, were constantly toiling to reduce the variations of the compass to intelligible and certain laws. At the next meeting of the Institution of Naval Architects, these gentlemen are likely to congratulate each other and the world, that further labour in that direction is superfluous, and that the application of electricity to the compass is, in one day, of as much importance in the safe navigation of iron and iron-built ships, as the invention of the compass was in early times. Iron ships and iron cargoes may be said to have deprived the sailor of the use of the compass; and the application of electricity to have restored it to him.

That the importance of Mr. Gisborne's simple application of electricity to the compass may be clearly understood, it may be well to state that the Liverpool Compass Committee, Mr. Evans, Mr. Smith, and the Astronomer Royal obtained from Mr. Fairbairn [illegible] plates, each [illegible] in. long, 4 in. broad, and ½ in. thick, to verify by experiment that the power of malleable iron for the reception and retention of subpermanent magnetism depends on the degree of heat at which the iron is passed through the rolls. "On collecting," he observes, "all the results (after repeated annihilations and revivals of magnetism) with the unlettered end downwards, the magnetism of the cold rolled longitudinal bars is greater than that of the other bars in the proportion of about 14 to 10; while those with the lettered end downwards are about 11 to 10." Here obviously we have a key to much that has been, and as to good and bad iron for the construction of ships the good iron being that which would lead to little compass variation, and the bad iron that which would lead to considerable or excessive compass variation. But the inquiries and deductions of the Astronomer Royal have been pushed much further. He goes so far as to recommend that iron ships should be built with the keel nearly north and south. The results of Mr. Smith's studies may be summed up in the one sentence that "the north end of the keel is attracted to that part of the iron hull which was furthest from the north in building." In other words, if the head of an iron ship is built towards the north, the needle will point towards the south; and if the head of an iron ship is built towards the south the needle will point towards the north; and so on—the general laws being disturbed and counteracted in endless ways. Mr. Evans again tells us that the "Warrior" was built head north 8 deg. east, and the armour put on head north-west; the "Black Prince" built head south, 20 deg. east, and the armour put on head south; and the "Defence" built head south, 47 deg. west., and the armour put on head south, 19 deg. east. He says, "The general law obtains in these ships that the point of the compass is drawn towards that part of the ship which was south in building." Mr. Evans has also told us the precise amount of compass variations: 1st, in sailing vessels, wood built; 2nd, in steam vessels, wood built; 3rd, in vessels built partly of wood and iron; 4th, in steam and sailing vessels, iron built; and 5th, in iron-plated ships. In a wooden sailing ship the north end of the needle is drawn to the ship's head, and the amount is small; engines and boilers increase the amount; and, as observed before, if an iron ship is built north, so great is the variation that the needle will point south. The ill-fated "Royal Charter" had a large amount of variation. Last of all, Mr. Rundell, on behalf of the Liverpool Compass Committee, tells us many things. He says "that many captains, finding the errors of their compasses constantly vary with change of latitude, dispense with compensation of any kind, and trust entirely to constant celestial observation for determining the amount and direction of these errors." But it is needless to enlarge. Up to the present time so much uncertainty has attached to the navigation of iron vessels from the variations of the compass, that it is a marvel so few iron vessels are lost annually, and so few of our brave seamen perish.

Mr. Gisborne's electric compass was tried recently for three days on board the iron steamer "Resolute" in the Mersey. It was uninfluenced by the iron of the vessel, and worked correctly when placed over the engines and between the chimneys. Not so the ordinary compass of the "Resolute" with the well-known magnetic adjustments; the variations being 1½ to 1¾ points. Piles of steel and iron shavings placed round the electric compass do not act upon the needle, and it is alike insensible to the presence of bars of iron on the top of the box. Tests such as these are demonstrations that currents of electricity restore the compass to the sailor as unvarying and trustworthy as when steam machinery, iron hulls, masts, and rigging were unknown. Mr. Gisborne is an eminent electrician, and having crossed the Atlantic frequently, it occurred to him to try electric currents as a means of checking compass variations. The thought was a happy one, and Mr. Gisborne is now to be regarded as one of the benefactors of mankind. The immediate and peremptory adoption of the electric compass would spare thousands of lives and value to the extent of millions every year.

LAUNCH OF A RUSSIAN IRON-CLAD.

On Monday afternoon the first iron-cased frigate for the Russian navy was launched from the yard of the Thames Ironworks, which has had the honour of building the first ships of this description for the English, Danish, and Russian navies, and which is now constructing the first frigates of the same kind for the navies of Spain and Turkey. The "Pervenitz," as the new Russian frigate was named, is probably one of the ugliest vessels that has ever floated from the yard of the Thames Works—not only uglier than the "Resistance" and the "Defence," but as ugly even as the much-vaunted American invention, the floating "Derrick," which has never had anything to do but float since the day she was launched. To see the "Pervenitz" as she was towed out of the creek, with her narrow receding sides and uncouth projecting snout, above which the red hawse-holes flamed like the eyes of a monster, she more resembled the quaint hideous forms of the Chinese junks than any European man-of-war we have yet seen in the Thames. This Russian frigate, which has been some time building, from designs furnished from Russia, represents with peculiar force the rapid strides with which the construction of iron frigates has advanced in this country within the last two or three years. At the time the "Pervenitz" was first thought of, all the world seemed in favour of using such armour-coated vessels mainly as steam rams, and, accordingly, the Russian frigate has been produced not only with a beak, but a monstrous projection under her bows and level with the water-line long enough and strong enough to transfix the stoutest three-decker that ever floated. In the same way a great angle of incline inwards for the sides was thought an absolute necessity for iron-clads to assist the shot in glancing, so the "Pervenitz" has her sides sloping in at an angle of no less than 27 deg.—an amount of incline which is an evil, in many ways, and which experience shows, even if it were increased to 45 deg., would have but little effect in diminishing the terrible powers of such ordnance as are daily tried at Shoeburyness. These drawbacks, the beak and the slope of sides, will prove serious obstacles when at sea; the former to her speed, and the latter to her steadiness in a seaway. Unlike the "Warrior," to imitate which she was ostensibly built by Russia, the thickness of the teak backing behind the armour plates is diminished from 18 in. to 9 in., though this disadvantage is, perhaps, on the whole, compensated by the reduction of weight, which enables her to carry her armour of 4½ in. plates from end to end and over her beaks (for she has two) at stem and stern. The total length of the vessel between perpendiculars, and exclusive of the beaks, is 200 ft.; her breadth, 53 ft.; depth, 26 ft. 6 in.; and the burden, according to the builder's measurement, is, in round numbers, 3,000 tons. When fully equipped for sea, her draught of water will be 14 ft., and the armament she is intended to carry is 28 68-pounders on her main deck, all protected by her armour plates, with two large pivot rifled 100-pounders on the upper deck. Thus armed and equipped, her portsills will be 6½ ft. above the water—nearly 3 ft. nearer the water than those of the "Warrior" class, and rather more than 1 ft. higher from it than the portsills of the once famous "La Gloire." With anything like tolerable speed, and fair weather to act in, the "Pervenitz" would be a formidable vessel. As it is, she will scarcely be formidable to sailing vessels, unless she catches them becalmed, for her horse-power, instead of being at least 600, is only 300, which, with the great displacement of her midship section, the bulk and weight of her huge beak under water forward, and the dead water she is sure to tow after her beak astern, all seem to show that even in her trial trip nine knots is likely to be her highest rate of speed. In a seaway we shall be much mistaken if she can command even this average momentum. The launch, as is usual with all the launches at the Thames Works, was managed to perfection. The Earl of Caithness, the Earl of Macclesfield, Lord Wenlock, Lord Richard Grosvenor, Mr. W. S. Lindsay, M.P., Mr. Ayrton, M.P., with a number of Russian officers, the directors of the Thames Company, and a large circle of invited guests, were present on the occasion. At 2 o'clock Miss Hume christened the vessel, and at once, without check or hindrance, she went down the slips into the water with perfect ease. On the water, as we have said, she looked intolerably ugly, and, what is more, seemed to show that she must prove a wet, heavy, and most uncomfortable boat in dirty weather. In a head sea her bows will always be awash, while the incline of her sides, or "tumble home," will facilitate to the very utmost her tumbling everywhere in a heavy swell. It was impossible to look at her whole form, at the designs for the construction of the Spanish and Turkish frigates, and then turn to the colossal shape, yet exquisitely fine lines, of the "Minotaur" building in the same yard for our navy, without feeling at once the almost immeasurable superiority in size, in strength, and in speed which the English ships of this class possess. Almost every iron-clad frigate or floating battery in the world, except the American failures and two frigates constructing in France for the Italian Government, is being built in England for foreign Governments. An impartial examination of all these varied plans and systems affords the most convincing proof that in size, speed, and strength our iron-clads are as much beyond those of foreign navies as our screw liners are beyond the old sailing 74's of 20 years ago. There is not a foreign iron-clad on which half as much money has been spent, ton for ton as with every economy we are obliged to spend on ours to make them perfect, and there is not as yet one foreign iron-clad which in real efficiency is worth a tenth of one of ours.—*Times*.

M'CARTHY'S AUTOMATIC SAFETY VALVE.

The accompanying engravings illustrate an invention recently patented by Mr. C. M'Carthy, of New York, for an automatic safety valve. The invention consists in so arranging the valve that on any excess of pressure in the boiler, steam and water may be blown into the fire-box by means of pipes, and thereby act as a damper. Below the valve seat a pipe C is connected, running downwards in the boiler to within a few inches of the bottom. When the boiler is in operation, the steam will force the water into the pipe C, and through the valve into the chamber B, and pass off by the pipe E into the fire-box. In the chamber B a spindle is arranged, passing through a stuffing-box through one side of the chamber. Upon this spindle is attached a lever, which acts upon the under side of the weight W, or upon a collar on the stem of the valve, so as to raise the valve when desired. Upon the end of this spindle, on the outside of the chamber B, a lever is fastened, through which the forked lever and valve may at any time be operated. The levers are so arranged that they will operate the valve only for the purpose of raising it, and without interfering with its free action. In the inside of the boiler a float L is arranged, floating upon the water, and provided with a rod passing through a stuffing-box in the top of the boiler. On the end of this rod a slot *m* is arranged, in which the pin on the end of the lever fits. This slot *m* is of such a length as to allow sufficient play without coming in contact with the pin, when the float L rises or falls according as the level of the water in the boiler rises or falls, until the float L falls to a certain point below the fixed water level, on account of the falling of the water to that point, when the top of the slot *m* comes in contact with the pin upon the lever, so as to operate the forked arm and raise the valve, when the water from the lower part of the boiler will be forced through the valve, escaping from the chamber through the pipes E, and be thrown upon the fire, thereby extinguishing the same.

By the above it will be perceived that by this arrangement the fire in the grate will be extinguished before the top flue plates will be exposed to any undue heat, consequently removing always all danger arising from a deficiency of water while the fire is in full operation.

From the above described arrangement it will be readily understood that this valve operates effectively in both cases, and from these most accidents in steam boilers result, namely, from an excess of pressure in the boiler, and secondly, from a deficiency of water in the boiler; and, at the same time, it acts in such a manner as to remove the primary cause of all accidents, namely, the fire, which, by the operation of this improved valve, is either deadened or quite extinguished.

As the float L works quite independently of the safely valve until the water falls below a certain point, it may be made to act as a water indicator, to show the level of the water in the boiler. A connection is in that case made between the float rod and a dial, or any other equivalent or similar mechanical contrivance.

M'CARTHY'S AUTOMATIC SAFETY VALVE.

FIG. 2.

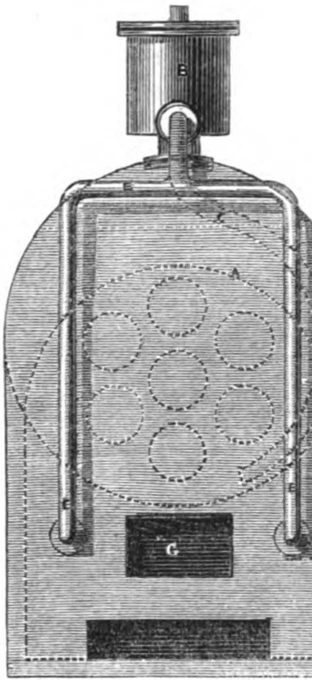
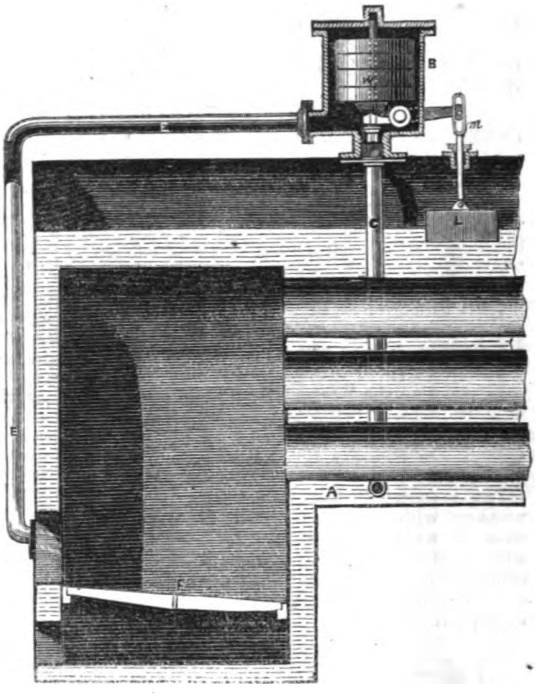


FIG. 1.



SHEDLOCK'S GAS-METERS.

This invention, just patented by Mr. J. J. Shedlock, of Cambridge-street, Pimlico, has for its object improvements in wet gas-meters. In order that a wet gas-meter may be rendered the more sure and perfect in its registration, the drum or measuring wheel is surrounded with an annular float or air-tight vessel of sufficient capacity to displace a volume of water equal in weight to the drum, so that by possessing a buoyancy it can rise as the water rises, or fall as the water decreases in the case, or, more properly speaking, that the water always mantains the same level in the drum or measuring wheel. The two ends of the shaft or axis of the drum pass through and are guided by a retangular frame or double lever, which is supported and carried by two fixed pivot or bearings forming the fulcrum. Upon one end of the lever or frame is secured a curved gas-holder, which is intended to neutralize the effect of the sudden entry of gas at a high pressure into the drum or measuring wheel. Upon the other end of the frame is attached a balance weight equal to the weight of the curved gas-holder. By the retangular frame or lever vibrating on the fixed points or pivots, the drum or measuring wheel is constrained to form an arc in following the variations of the water level. The frame is curved so as to allow the spout or the supply pipe to pass into the drum. The gas entering the meter passes through the inlet valve, which is attached to and acted upon by a small float resting upon and governed by the water in the case; the gas then passes through a second valve, which being suspended, is acted upon solely by the position of the meter—thus, if the meter be horizontal, the gas passes freely through; but if inclined, the gas is immediately shut off until the meter be replaced in its former horizontal position. The gas, after passing the two valves, enters a chamber, into which the supply pipes to the drum or measuring wheel and the curved gas-holder are inserted. The

SHEDLOCK'S GAS METERS.

FIG. 1

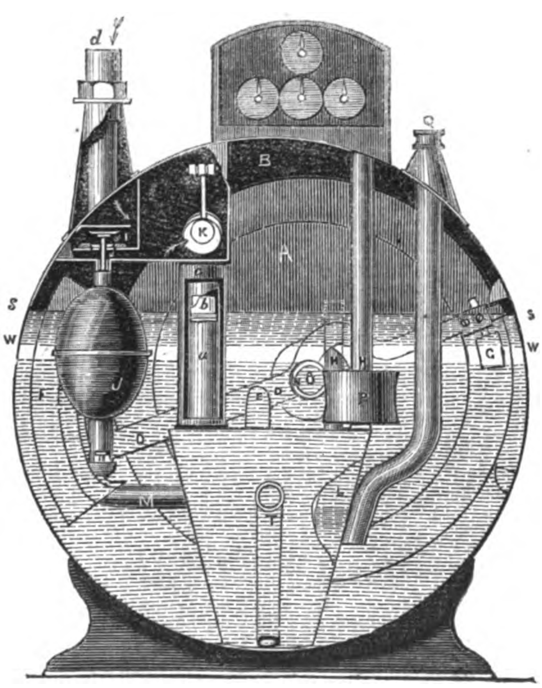
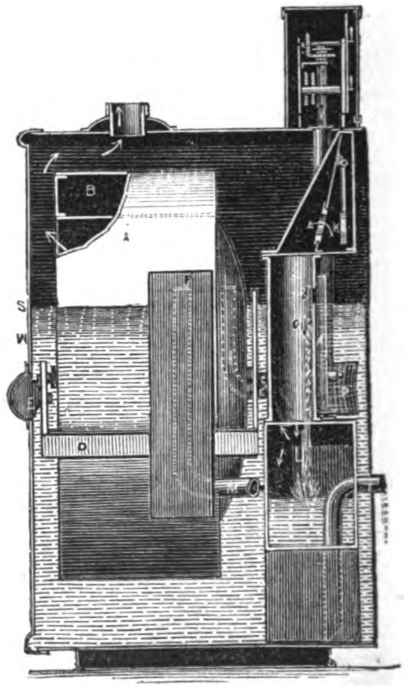


FIG. 2.



HARVEY'S BORING MACHINERY.

FIG. 1.

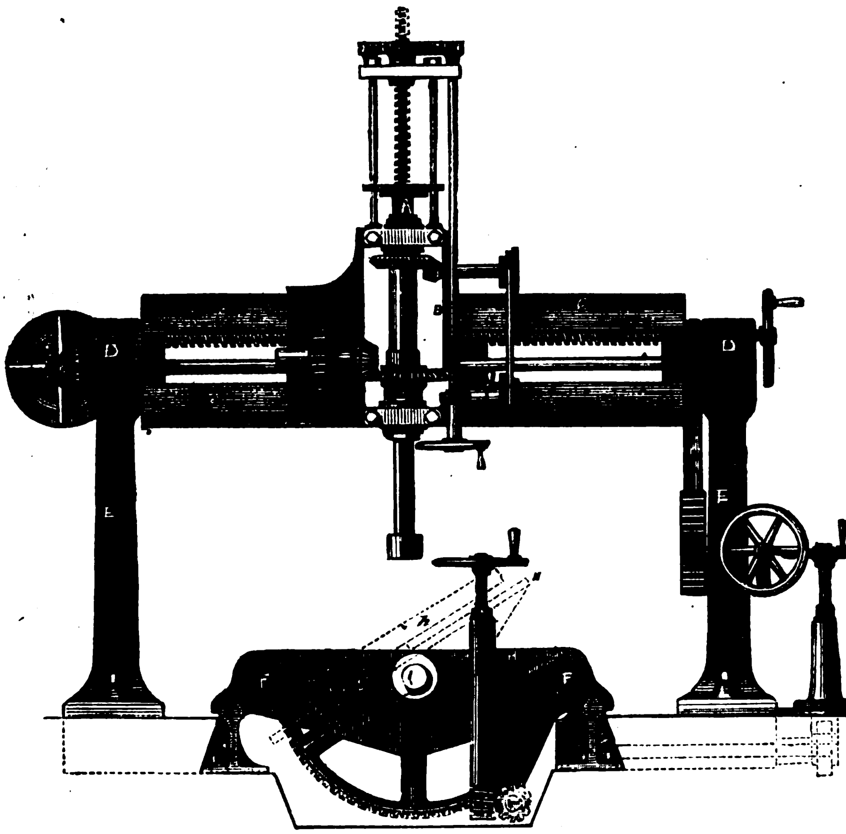
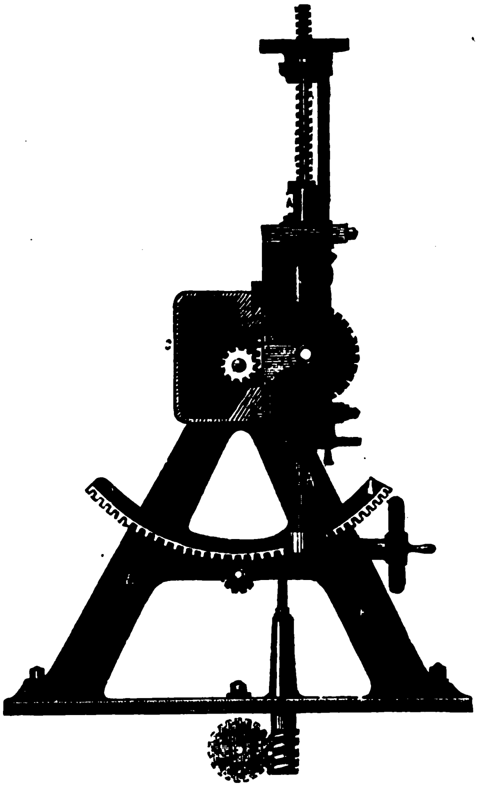


FIG. 2.



shaft or axis of the drum or measuring wheel is fitted with a worm, by which means motion is carried to the index or registering apparatus through a long toothed pinion fixed to a spindle placed at right angles with the shaft or axis of the drum; provision is made in the long pinion attached to the index spindle for the arc described by the worm attached to the axis of the drum, by cutting the teeth of the pinion of the same radius as that caused by the drum rising and falling, thus the worm presses equally and directly on the teeth of the pinion. Motion is thus carried into the registering apparatus, which is of the ordinary kind.

Fig. 1 of the annexed engravings is a front elevation, partly in section; and fig. 2 is a side elevation, also partly in section, of a gas-meter constructed according to this invention.

A is the drum or measuring wheel, upon the periphery of which is constructed the annular ring or air-tight vessel B. The shafts or axes C, C, of the drum A pass through and are guided by the rectangular frame or double lever D, D, upon one end of which is attached the curved gas-holder F, and on the other end the weight G, or equipoise of the curved gas-holder. E, E, are the points or pivots upon which the frame D, D, vibrates. The meter is charged with water at the plug Q, and passing down the pipe, enters, and filling, the case, buoys up the annular float B and the drum or measuring wheel A. The highest water level S, S, is fixed and determined by the water rising up the pipe *a* and overflowing at the opening *b* through the pipe *c* into the waste water box L, from whence it is allowed to run off by the pipe T. The float J begins to rise when the water arrives at the level W, W, carrying with it the inlet valve I, to which it is attached by the wire as shown, passing through the float J. The gas enters at the inlet union *d*, and passing down the pipe, enters the valve box (the passage of the gas is indicated by the arrows), passing the valve I, into the second valve box and through its valve K, which, being suspended, is effected only by the position of the meter, that is, should the meter be inclined to the back, the valve falls upon its seat and effectually prevents gas from passing until the meter be replaced in its former horizontal position. The gas then passes down the pipe *c* into the waste box L, thence passing up the pipe M to the curved gas-holder F, and up the pipe H into the drum or measuring wheel A, through which the gas passes measured to the outlet union U. The passage of the gas through the drum A causing it to rotate, transmits motion to the index apparatus through the worm N, which is fixed on the axis of the drum and the pinion P, to which is attached the upright spindle V. The index is acted upon bp the spindle V in the ordinary manner. The variation of the water level has no effect upon the registration, as the drum or measuring wheel A in following the water mantains always the correct level in the interior of the drum. The water falling to the level W, W, brings the float J down, thus closing the valve I, and effectually preventing the passage of the gas through the meter.

HARVEY'S PATENT BORING MACHINERY.

A PATENT has been obtained by Messrs. G. and A. Harvey, of Glasgow, for an improved arrangement of machinery for boring holes either in flat or curved plates. Fig. 1 of the annexed engravings is a front elevation of the machinery, and fig. 2 is a side elevation partly in vertical section. In this arrangement the boring spindle A and its driving and feeding details are fitted upon a slide or carriage B, capable of adjustment transversely upon a horizontal guide piece C by means of a screw spindle and hand wheel. The guide piece C is formed with journals at the ends, fitted to turn in bearings D upon standards E bolted to the foundation, and is provided with adjusting mechanism whereby the boring spindle may be inclined to any convenient degree from the vertical in what may be termed the backward and forward direction. The adjusting arrangements consist of a toothed sector fixed on one end of the guide piece C inside the standard E, and in gear with a pinion on a spindle turning in a bearing formed through the standard. On the other end of the spindle there is a worm wheel which is actuated by a worm on the spindle of a hand wheel. To receive and hold the plate or other article there is provided a slide or carriage F, capable of adjustment backwards or forwards upon horizontal guide rails G, arranged below and at right angles to the inclinable guide piece C, and strongly bolted to the foundation. To adjust the slide F backwards or forwards, there is fixed to it at one side a rack with which there gears a pinion on a horizontal shaft (indicated by dotted lines in fig. 1), and this shaft has fast on its other end a worm wheel actuated by a worm on the lower end of a vertical spindle fitted with a hand wheel at its top end. The plate or other article is fixed upon a table indicated by dotted lines at H, and formed with journals I to turn in bearings in the frame of the slide or carriage F. This table H is fitted with adjusting mechanism, whereby the plate or other article upon it may be set at any convenient inclination, but in a direction at right-angles to the direction in which the boring spindle A can be inclined. The adjusting mechanism consists, in this example, of a toothed sector fixed to the table H, and there gears with this sector a pinion on a short spindle carried by the frame F, the spindle having also fast on it a worm wheel actuated by a worm on the lower end of a vertical spindle fitted with a hand wheel. With these arrangements, after the plate or other article has been fixed upon its table or carriage H, it may with the greatest facility be moved by means of the various adjusting mechanism, hereinbefore described, into every position required for boring the holes in it, whatever may be the inclination or direction to be given to the holes within the range of inclination for which the machine is constructed.

The arrangements for driving the drill spindle A may be varied, but those shown in the engraving are simple and convenient—a cross shaft, carrying a driving pulley and a bevel pinion in gear with another wheel on a horizontal shaft placed in bearings in the journals of the inclinable guide piece C so as to lie in the axis of this guide piece; this shaft is fitted with a feather and pinion, which, by flanges on the inside of the slide B, is made to accompany this slide, so as to be always in gear with a spur wheel upon a short spindle carried by the slide. On the spindle of the spur wheel there is a bevel pinion in gear with a bevel wheel on the tubular spindle, which is mounted in upper and lower bearings on the slide B, and has the drill spindle A passing through it, being driven by a groove and feather, which admits of the requisite movement. The drill spindle A is moved or fed downwards by a screw spindle, formed with a cross-head on its lower end and guided upon a pair of rods. A cross-head is fixed on the top of the rods, and carries a spur wheel, through which the screwed spindle passes, which is, in consequence, raised or lowered by turning the wheel. The spur wheel is turned by a pinion fixed on the top of a spindle carried by the slide, and having a hand wheel on its lower end for adjusting by hand. Self-acting feeding gear is also added, there being on the spindle a worm wheel, actuated by a worm on a spindle fitted with stepped pulleys, to be driven by a belt from similar pulleys on a spindle carried by the slide and driven by a bevel pinion in gear with a bevel wheel on the tubular spindle.

ABRIDGMENTS OF SPECIFICATIONS.

An important reduction in the prices of the abridgments of specifications of patented invention has just taken place. We have great pleasure in announcing the new list of prices to enable inventors and others interested to compare them with the former list.

These books are of 12mo size, and as each is limited to inventions of one class only, they can be sold at prices sufficiently moderate to enable the humblest inventor to examine for himself whether his discovery has been previously patented or not.

At the foot of each abstract are given reference to notices of the inventions in scientific and other works, and to the reports of law proceedings for infringements, &c. &c. &c.

The classes already published are,—

		s.	d.		Former Price. s.	d.
1.	Drain Tiles and Pipes, price	0	4	...	0	6
2.	Sewing and Embroidering	0	6	...	0	6
3.	Manure	0	4	...	0	6
4.	Preservation of Food	0	4	...	0	6
5.	Marine Propulsion	1	10	...	4	0
6.	Manufacture of Iron and Steel	1	6	...	5	0
7.	Aids to Locomotion	0	6	...	1	0
8.	Steam Culture	0	8	...	2	0
9.	Watches, Clocks, and other Timekeepers	0	8	...	1	6
10.	Firearms and other Weapons, Ammunition, and Accoutrements	1	4	...	6	6
11.	Paper—Part I. Manufacture of Paper, Pasteboard, and Papier Mâché	0	10	...	3	0
12.	Paper—Part II. Cutting, Folding, and Ornamenting; including Envelopes, Cards, Paper-hangings, &c.	0	8	...	2	0
13.	Typographic, Lithographic, and Plate Printing	2	8	...	7	0
14.	Bleaching, Dyeing, and Printing Yarns and Fabrics	3	4	...	9	6
15.	Electricity and Magnetism: their Generation and Applications.	3	2	...	8	6
16.	Manufacture and Applications of India Rubber, Gutta Percha, &c.; including Air, Fire, and Water Proofing	2	8	...	10	0
17.	Production and Applications of Gas	2	4	...	7	0
18.	Metals and Alloys	1	10	...	9	0
19.	Photography	0	8	...	2	0
20.	Weaving	4	0	...	14	0
21.	Ship Building, Repairing, Sheathing, Launching, &c.	2	4	...	7	0
22.	Bricks and Tiles	1	0	...	4	0
23.	Coating Metals with Metals	0	10	...	2	4
24.	Pottery	0	10	...	2	8
		£1 15	2		£5 8	0

The following are in the press:—

Preparation of Fuel, and Apparatus for its combustion.
Steam Engines.
Spinning.
Railway Signals.
Mining and Metallurgy.
Music and Musical Instruments.
Railways and Rolling Stock.
Hydraulics.

The contents of the above have been classed and chronologically arranged under the immediate superintendence of Mr. B. Woodcroft, the chief of the Specification Department.

Meetings for the Week.

Mon.—*Linnæan Soc.*—Anniversary Meeting, at 3 p.m.

Tues.—*Royal Inst.*—"On Sound," by Prof. Tyndall, at 3 p.m.

Wed.—*Soc. of Arts.*—At 8 p.m.

Thurs.—*Royal Inst.*—"On Geology," by Prof. Ansted, at 3 p.m.

Inventors' Inst.—"On Inventions relating to Suspension Bridges," by A. Sedley, Esq., at 8 p.m.

Fri. — *United Service Inst.*—"Naval and Military Signals," by Lieut. F. H. Colomb, at 3 p.m.

Royal Inst.—"On the Vedas," by Prof. Max Müller, at 8 p.m.

Architectural Assoc.—"On Building Materials and their Adaptation," by Arthur Allom, Esq.

Sat. — *Royal Soc.*—"On Electric Telegraphy," by Prof. W. Thompson, at 3 p.m.

Miscellanea.

At the late session of Congress, U.S., an act was passed for the formation of a National Academy of Sciences, and 50 corporators, mostly members of the American Association for the Advancement of Science, were included in the bill. A preliminary meeting of the corporators was held, and 50 members were present, Professor Joseph Henry, of the Smithsonian Institute, was chosen president. A committee was appointed to report a plan of organization for the Academy.

An ingenious German mechanic in Washington, U.S., has nearly perfected a new telegraph instrument, which is on an entirely different principle from those now in use, and may prove far superior to any of them. He is aided by two wealthy newspaper proprietors, who supply him with ample means for making his experiments.

Mr. James Chalmers in a letter says:—Sir,—As the comparative weights of the "Warrior" target and mine have been misunderstood, perhaps you will permit me to state the weight of the former, as given by the Special Committee on Iron —viz., 32 tons 9 cwt. 3 qrs. This gives for an area of 200 ft., after deducting a porthole 3ft. 4 in. by 2 ft., 376½ lb. per foot nearly. The weight of my target, as calculated for the Admiralty by the Engineer Department, is 371½ lb., or 5 lb. less than the weight of the standard target, as given by the committee. This, however, was found to be incorrect, the correct weight being 346·8 or 347, as in the account of the trial of my target in *The Times* of the 27th ult. I was not aware of the error in the weight of the "Warrior" target till it was too late to alter my plan, but, as it had been the criterion for subsequent targets, the committee frankly stated that I was justified in taking it for mine. The plan is now before the Admiralty, with such alterations as will bring it within the standard weight, and probably increase its powers of resistance, as compared with my first target, 25 or 30 per cent.

It was announced at the last meeting of the Institution of Civil Engineers, that the President's annual *conversazione* would be held on Tuesday evening, June 2nd, when the co-operation of members and visitors was requested, in order that a collection of models of engineering construction, and of specimens of works of art, worthy of the Institution, might be made.

The following circular has been forwarded to us:—3, Leadenhall-street, London, 1863.—I am requested to inform you that Mr. Robert Armstrong, C.E., the author of a Treatise on Steam Boilers, and other works and contributions to engineering literature, has, in consequence of accidents which he met with some months since, and also recently, which induced lameness and general debility, been incapacitated from following his usual avocations, and is thereby placed in circumstances of difficulty and distress. It has, in consequence, been resolved by a few of Mr. Armstrong's friends, to endeavour to extricate him from his painful position, and to assist him at his advanced age (69) by raising a small fund for the purpose of placing him in some line of business, or otherwise, by which he may obtain a livelihood. With this view, they solicit your cooperation by contributions and suggestions as to the course to be pursued, and earnestly invite you to associate yourselves with them in acting as a committee for the promotion of the object they have in view. Reference is kindly permitted to be made to Wm. Langdon, Esq., 18, London-street; John Mathewson, Esq., 138, Leadenhall-street; Daniel Kinnear Clark, Esq., 11, Adam-street, Adelphi; Wm. Humber, Esq., C.E., 20, Abingdon-street, Westminster; Benjamin Fothergill, Esq., C.E., 65, Cannon-street, E.C.; Thos. Wright, Esq., C.E., 9, George-yard, Lombard-street; and also to Messrs. W. E. Corner and Son, 83, Gracechurch-street, London.—I am, yours faithfully, Matthew A. Soul. Subscriptions have already been received from:—

	£	s.	d.
Messrs. John Penn & Son, Greenwich	£5	0	0
" James Watt & Co., London	5	0	0
Wm. Langdon, Esq., London	5	0	0
Benjamin Fothergill, Esq., London	3	3	0
Messrs. G. Forrester & Co., Liverpool	3	0	0

and several other firms and gentlemen.

Curious Model of Naval Architecture.—An interesting work of art was on Wednesday on view in the Exchange News-room, Liverpool. It is a correct model, executed in ivory, of the "St. George" line-of-battle ship, of 120 guns, built, planked, and copper-fastened throughout, with all the masts, yards, &c., complete. The model was made expressly for the late Duke of Buckingham, and the period occupied by the artisan in completing his tedious and difficult task was about two years. The antique build of the "St. George" contrasts strikingly with our modern clipper ships.

The Inventors' Institute.—The first annual general meeting of this society took place on Thursday, the 14th inst., at 9, Conduit-street, Regent-street, London. The meeting was numerously attended. Amongst those present were General Sir John Scott Lillie, C.B., Admiral Sir E. Belcher, C.B.; F. B. Beamish, Esq., M.P.; Sir Patrick O'Brien, M.P.; Dr. Normandy; Captain Selwyn, R.N.; Captain Rodgers, R.N.; Mr. Robert Richardson, C.E.; Mr. Benjamin Burliegh; Mr. C. Varley, &c. General Sir John Scott Lillie occupied the chair. A report was read by the honorary secretary, who also read the audited statement of accounts, from which it appeared that after defraying the expenses of the past year and also those incidental to the formation of the Institute there remained a balance in favour of the Institute of upwards of £90. The report and accounts were unanimously adopted, and the council was unanimously re-elected for the ensuing year. After the proceedings of the general meeting had terminated, several of the members adjourned to St. James's-hall to partake of the first anniversary dinner of the Institute. The Earl of Caithness, a vice-president, was unavoidably prevented from occupying the chair, but his place was filled by Lord Richard Grosvenor, M.P., also a vice-president. About seventy gentlemen were present at the dinner, after which the various toasts were replied to by the following gentlemen—viz., General Sir John Scott Lillie, C.B., Captain Rodgers, R.N., William Henry Barlow, Esq., C.E., F.R.S., Hume Williams, Esq., Sir P. O'Brien, M.P., Thomas Webster, Esq., F.R.S., Robert Richardson, Esq., C.E., &c.

Big Ships and Cannon.—Mr. James Bruce in a letter says:—The first ship seen in Greece, arrived at Rhodes, A.D. 1485—Hiero's ship, which was built under the direction of Archimedes, had wood enough employed in it to make gallies to the number of sixty. It had all the varieties of apartments of a palace—banqueting rooms, galleries, gardens, fishponds, stables, mills, baths, a temple of Venus, &c. It was encompassed with an iron rampart and eight towers, with walls and bulwarks furnished with machines of war, particularly one which threw a stone of 300 pounds, or a dart twelve cubits long, the space of half a mile, &c. This ship has been described by Athenæus, the mathematician, who wrote a Greek treatise "On Machines of War." Mahommed II., at the siege of Constantinople, A.D. 1453, used 800-pounders. In 1807, when Sir J. Duckworth passed the Dardanelles, his fleet was dreadfully shattered by the immense shot! The "Royal George," of 110 guns, was nearly sunk by one shot, which carried away her cutwater, and cut the mainmast of the "Windsor Castle" nearly in two; one single shot knocked two ports of the "Thunderer" into one. The "Repulse," 74 guns, had her wheel shot away, and 24 men killed and wounded by a single shot, nor was the ship saved by the most wonderful exertions. These shot were of granite, and weighed 800 lb., and were 2 ft. and 2 in. in diameter. One of these huge shot stove in the larboard bow of the "Actiæ," and having then crushed the immense mass of timber, the shot rolled ponderously aft, and brought up abreast the main hatchway. One of these guns was cast in brass in the reign of Amurath, it was composed of two parts, joined by a screw at the chamber, its breach resting against massive stone work. Baron de Trott resolved to fire this gun, the shot weighing 1,100 lb., and he loaded it with 330 pounds of powder. He says, "I felt a shock like an earthquake, at the distance of 800 fathoms."

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—J. B.—A. R. M.—R. K.—C. R.—M. B.—R. S.—W. B.—R. E.—J. H.—Capt. S. (next week).—W. J. C.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

AN ATLANTIC TELEGRAPH.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—Resuming my answers to the objections to surface telegraphy stated by Captain Selwyn, I have to remark, as regards the objection that icebergs would come into collision with the cable, that there is nothing to warrant any such conclusion. For, as to the northern route, there are admittedly no icebergs from Scotland to Iceland. From Iceland to near Cape Farewell there also none. Near and at Cape Farewell it would appear there are none; for Sir Edward Belcher, in his evidence (Report on Submarine Cables, page 244, question 4,281), says:—"The heavy ice never presses upon Cape Farewell, and never has been known to touch the southern part of that land at all." Besides, the cable, it will be recollected, will, where it approaches land, always be laid at the bottom, thus obviating Captain Selwyn's objection. Then from Cape Farewell to near Newfoundland, there are, so far as I can ascertain, no icebergs. At Newfoundland they are to be encountered at the season when they come from the Labrador shore along the coast of Newfoundland. But the cable would of course be laid there, as elsewhere on approaching land, at the bottom, thus again obviating the Captain's objection. It may be remarked that the icebergs in Davis's Straits, and in the Atlantic, between Greenland, Labrador, and Newfoundland, are driven and kept to the westward towards and upon the Labrador shore, by the prevalence of the north-easterly winds in that region in the spring months, and it is only when that wind ceases that they float along Newfoundland. And this is the reason why, by adopting the easterly path above pointed out for the cable (easterly as regards Labrador), it would be free from all real danger from ice—as free as the southern cable was, and is, held to have been—and we are all aware that it was not ice that made that cable fail, and that no danger from ice was ever seriously apprehended with reference to it.

Now this conclusion as to the entire safety of the northern cable laid, as proposed, is arrived at, even though icebergs were fully as formidable as they have been generally represented to be. But, after all, do we really know, with scientific accuracy, based upon actual observation, anything sufficiently reliable to warrant the conclusions generally held at present as to icebergs—the exact nature of the ice of which they are formed, their shape, their dimensions, and particularly their depth in the water? It is believed that all these points have been much misunderstood and greatly exaggerated. In conclusive proof of this, we find Sir Edward Belcher, whose experience is beyond all question, saying (p. 245, q. 4,316):—"The greatest measured height of any iceberg that I ever saw was 150 ft., as a pinnacle, and when it canted or turned bottom upwards, it was not above 80 ft." But his letter at page 250 is still more instructive, and on account of its importance I beg to be allowed to quote the following paragraph in full:—"And with regard to the action of bergs on the bottom, and their flotation, notwithstanding experiment on small masses, we certainly witness instances, where we find them *aground, totally at variance with calculation* as regards specific gravity. Two occurred in our last expedition. The first was off the Port of Lievely (Disko), where the 'Pioneer' lost her mizenmast, by falling foul of one aground in 16 fathoms. If the calculated height above water was taken into consideration that berg should have been immersed 800 ft., and yet it was aground in 96, and, further, moved away in 24 hours!" He also mentions another:—"A very large berg, aground in Freshwater Bay, outside the Port (St. John's), from which we obtained fresh water, and at which the boat's guns were fired to shake it. Its outer edge was in six fathoms, its summit about 40 ft. above the sea level." These, and the other facts stated in Sir Edward's Letter, prove that when icebergs are brought under actual and close examination, their supposed extremely huge dimensions *and great depth in the water*, dwindle away to something extremely moderate indeed—to a depth, in short, no way calculated to impede surface telegraphy in the very least degree. Captain Selwyn will thus see that his objection, based on icebergs, is altogether untenable on every ground.

Captain Selwyn again refers to "catenarian strain" as an objection to surface telegraphy. But he must be quite well aware that a wire rope could easily overcome all difficulty, with reference to the mooring of the buoys; and he should, therefore, abstain from further urging this as an objection.

He also refers to "barnacles" as an objection, founding on what "An Old Sailor" says. But my answer to the latter shows that this is no objection at all.

He also says, "I thought, I confess, that when it had been shown that a plan for laying cables near the surface failed in doing more than supporting it at some few points, the idea would be given up." Has the Captain himself ever tried the experiments, on which he bases this assertion and objection? When I did so in one of the ratios mentioned by him, and also in a much greater, I found that he was quite wrong in what he asserted, and that his objection was therefore very ill-founded. It may be necessary, however, for another reason than that assigned by him, to have more buoys. But now that deep sea bottom telegraph cables have failed so often, and are so objectionable on every ground from their position, and are therefore so certain to fail in future, the first point is, not so much, *how many* buoys would be required for a surface cable, but can we get a permanently working telegraph to America by means of buoys, though, in place of six, sixteen, or twice sixteen, were required? In any of these cases, the expense of the buoys, wire ropes, and anchors would be a perfect bagatelle compared to the whole expense and to the certainty of the successful working of the cable, the ample pecuniary return, and all the other great objects in view. It may be here remarked that there can be no real doubt that, judging from the way and length it worked, the cable from Valentia to Newfoundland was a good and sufficient cable, notwithstanding the objections (the most if not all of them imaginary) urged against it, in consequence of its failure; but the simple truth, no doubt, was and is, that it was *gradually* extinguished by the altogether overpowering disadvantages of its position; and such will also be the fate of every other cable, laid at the same depth, combined with so long a stretch, or even much less. But if we place the cable near the surface, every disadvantage disappears, and success is therefore certain.

With reference to what "An Old Sailor" alleged—that the nature of the bottom on which a cable is laid did not signify, I forgot to remind him, in addition to what I formerly said, that volcanic action sometimes takes place at the bottom of the sea, and that surface telegraphy would, of course, greatly diminish the risk to the cable of any evil influences from such a cause.

I may further mention, that I find I conceded too much to "An Old Sailor," in answering the objection, founded on "the insuperable difficulty" alleged by him in ascertaining the depth to within the number of fathoms I propose to submerge the buoys. According to Commander Dayman's clear and most authoritative statement (Report, p. 182, q. 3,110 to 3,116), there is no insuperable difficulty whatever in coming to an exact result as to the depth. It seems to be quite easily accomplished by the Commander's method.

In conclusion. If my plan seems to involve some trouble in its execution, I have yet to learn that anything truly good and great can be attained without due trouble; and it must be recollected that when a telegraph to America shall be achieved, and shall be working permanently, it will perhaps be regarded as the brightest and most consummate fruit of man's genius and invention; and it may, therefore, be most reasonably expected to require the fitting and ennobling exercise of his mechanical skill and power of adaptation to attain the end in view. But, on the other hand, it seems to me to be equally plain that there is no difficulty about its attainment in the mode proposed, entitled, in the very least degree, to the name of insuperable; that there is no difficulty in its attainment that the capital and mechanical skill of Great Britain could not overcome with the greatest ease, and at comparatively little cost if surface telegraphy is adopted, but not otherwise.

I beg to repeat the expression of my obligation to both Captain Selwyn and "An Old Sailor" for the trouble they have taken in the matter, and for the great kindness they have done me in stating their objections. New ideas, however valuable, have, generally, very much to contend against, and neglect is worst of all. But the facts and arguments, *pro* and *con*, in the present case, are now somewhat fully before your readers, subject to further remark or explanation that may seem necessary on either side. H. K.

Edinburgh, May 16, 1863.

MECHANICAL DEFECTS OF MODERN BOOKS.

Sir,—You will, probably, think that a few words will be of some service as regards certain defects of modern books, which defects may, with some latitude of expression, be termed mechanical ones.

The paper used, for the most part, instead of being crisp and elastic, as is the case with that composing many old books, particularly those of a scientific character, is flabby, and has the very disagreeable property of becoming creased by almost the slightest flexure, while its (generally speaking) unnecessary whiteness renders the faintest spots of dirt and stains discernible. And then, again, the ink latterly employed after a few years becomes very perceptibly brown, as clearly appears from the inspection of many works printed less than twenty years ago.

The ancient fashion of printing scientific and other illustrations upon sheets wider than the width of the pages, which fold over, the illustration being contained upon the extra width, by which means the reader could easily consult it when reading *elsewhere*, has, from some unknown cause, been discontinued, I believe universally. This method has several obvious advantages, and should, therefore, be revived.

I am, Sir, yours, &c.,

May 6th, 1863. J. A. Davis.

THE ALKALI MANUFACTURE NUISANCE.

Sir,—Lord Stanley of Alderley has lately introduced a bill into the House of Lords, having for its object, as in Lord Derby's bill of last session, the removal or destruction of the nuisance attending the manufacture of alkali.

Will you permit me, through the medium of your columns, to call the attention of Parliament and the public generally to some facts connected with the provisions of this measure, and to some recent improvements in the manufacture of alkali, which cannot be too generally known. It is proposed by the bill in question to limit the amount of nuisance so produced, by preventing the escape into the atmosphere of more than 5 per cent. of all muriatic acid manufactured, and to enforce this enactment by fine—the proof in each case being derived from the testimony of Government inspectors, who shall have power to enter manufacturing premises at any hour of the day or night.

At first sight it would appear to be a matter of impossibility to ascertain, except by a crude guess, whether 5, or 10, or 15 per cent. of this gas escaped into the atmosphere. I beg, however, to suggest to the Government a very simple clue, whereby, either in respect to this bill or any other of a similar character, the exact percentage of escape may be ascertained to the greatest nicety. For every 585 tons of common salt decomposed by sulphuric acid in the salt-pans and furnaces, 365 tons of dry muriatic acid are evolved—so that it is only for the product of condensation to be gauged, and its strength tested by the hydrometer, and the absolute percentage of escape is at once manifest.

This test, of course, implies the chemical purity of the salt employed, which may be ascertained by analysis; and it also implies the proper knowledge of the manufacturer, and the successful system of operation adopted by him, which in any legislative enactment of this kind are presumed as indispensable necessities.

But to come to the question of limitation contemplated by the bill—the permissive 5 per cent. Let it not be forgotten that it is a twentieth part of the whole quantity manufactured in Great Britain; that the gas in question is most baneful and destructive to animal and vegetable life; and that this twentieth part constitutes in the aggregate no slight contamination to a healthful atmosphere—no meanly poisonous and pernicious blast.

Taken the estimate so given by Lord Stanley of Alderley (which is rather below than above the mark) that the annual value of the alkali trade in Great Britain is equal two millions sterling—then, at the price of £10 a ton, this amount will represent 200,000 tons. Taking the proportion of pure alkali in the commercial article to be 50 per cent.—this gives 100,000 tons—and from the proportion already given, 62,400 tons of dry muriatic acid are evolved in the manufacture of this quantity—5 per cent of this is equal to 3,120 tons. Can any one not conversant with the manufacture imagine the evil resulting from the liberation of 3,120 tons of dry muriatic acid to commingle annually with the atmosphere of the manufacturing districts? Thirty years ago, when the alkali trade had not reached its present dimensions, and when the salt cake was manufactured in reverberatory furnaces, the whole of the muriatic acid was discharged into the atmosphere; and then, whenever a shaft of any importance reared its head, vegetation was more or less blasted over an aggregate area of several square miles, and what the effect of these emanations must have been and still is upon the human constitution may readily be understood by a very simple experiment. Let any one get a single ounce of the muriatic acid of commerce, and pour an ounce of vitriol upon it. The gas in question will be immediately given off, and will at once satisfy the experimentor of its injurious qualities, and oblige him to escape into a purer atmosphere. So intolerable and continuous a nuisance upon a scale of such magnitude as that involved in practice, became the fertile theme of litigation and compromise between the public and the manufacturers; and shafts of immense height were erected to convey the noxious gas into a higher stratum of the atmosphere; but even these, which can only be regarded as an abatement of the nuisance, were soon found to be insuffisient, and the present arrangements, which are those, no doubt, referred to by Lord Stanley of Alderley, as being able to absorb the principal bulk of the gas, came into operation. They are the invention of Mr. Gossage, and may be briefly described as a series of massive towers constructed of large rectangular slabs of silicious stone, and bound externally by stout iron clamps. They are filled throughout with coke—a small stream of water is allowed to trickle from above downwards, which meets the ascending gas, and in part absorbs it. What is not absorbed of the gas makes its escape into the atmosphere through an underground flue leading to the shaft, which arrangement is adopted in order to create a draught through the apparatus. The muriatic solution so produced is used subsequently to decompose peroxide of manganese for the purpose of producing bleach (hypochlorite of lime or bleaching powder). A far better method of destroying the nuisance, and utilizing the result, is to *imprison the muriatic acid from the atmosphere altogether*, and perform the two consecutive manufactures referred to in a single operation; and this brings me to the improvements adverted to in the beginning of my letter.

A patent has lately been taken by Messrs. Baggs and Simpson, of which the following is a brief summary:—They shut off all communication with the atmosphere, and compel the muriatic acid to enter a close vessel containing water and black oxide of manganese. As the pipe which conveys it dips into the water, it is instantly absorbed, and from the affinity existing between water and muriatic acid, considerable heat is evolved. This heat increases with the absorption, and in a few minutes becomes sufficiently great to decompose the manganese, and yield chlorine gas without the application of any external fire. Every particle of muriatic acid is, by these means, converted into chlorine, as it is evolved. Not a fraction per cent. is permitted to escape into the atmosphere, and the chlorine, as it is produced, is conducted by another pipe into a stone cistern containing lime and water, or into a leaden chamber containing hydrate of lime, where it is simultaneously converted either into a solution of bleach or into solid chloride of lime, according to the apparatus employed.

I have thought it better to give publicity to these facts while yet the bill is before Parliament; for in a measure so closely affecting the health of the public, and, I may also add, the economy of manufacture, I consider it not only behoves, but is the anxious wish of, the Legislature to have their prohibitory enactments relative to the correction of this serious nuisance upon the extreme susceptibilities of real and practical prevention as developed by the most modern discoveries.

I am, &c. ARGUS.

A PATENT GRIEVANCE.

SIR,—I am the victim of a grievance for which I do not see a remedy. I am an inventor, and, as a matter of course, a poor man. I have, however, hit upon an invention which I fancy will greatly improve my position—all inventors, you know, are sanguine. I have raised money enough to apply for a patent, hoping that, within the *six months* for which provisional protection is supposed to be granted, I shall be able to demonstrate the value of my invention, and so obtain assistance to proceed. I cannot, of course, try or perfect my invention until it is protected; and I now find, to my sorrow, that instead of the professed protection for *six* months, I shall probably not get *three!*

Upon filing my application for a patent, it was referred (being an odd number) to Her Majesty's Attorney-General, who is such a slow coach that, although just six weeks have elapsed, I have not yet received provisional protection. This officer is nearly two hundred patents in arrear of his brother Commissioner (for the even numbers) the Solicitor-General, who turns out his work in business-like style. Now, by the time I get Provisional Protection, give notice to proceed, and get my patent out of purgatory (risk of opposition), half the period of protection will be gone, and I shall probably break down.

If Mr. Attorney-General is unwilling or unable to do his duty, could he not turn one-half of it over to the Solicitor-General, who is two to one a better man for this kind of work? It is of no use going and complaining to Mr. Attorney's clerk, for I should only get put back, annoyed in all manner of legal ways, and perhaps be refused a patent. Like Archimedes of old (who could have moved the world) I could move the Attorney-General but for want of a fulcrum!

I remain, Sir, your obedient servant,
London, May 15, 1863. A LEVER.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

THE Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

STEAM ENGINES, &c., 2861, 2884, 2890,
BOILERS AND FURNACES, 2867, 2885.
SHIPS AND BOATS, including their fittings, 2857, 2864.
ROADS AND VEHICLES, including railway plant and carriages, saddlery and harness, &c., 2870, 2874.
CULTIVATION OF THE SOIL, including agricultural implements and machines, 2888.
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, 2853, 2854, 2887, 2891.
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c., 2866, 2880.
BUILDINGS AND BUILDING MATERIALS, 2863, 2893, 2898.
LIGHTING, HEATING, AND VENTILATING, 2851, 2869, 2873, 2877, 2883.
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c., 2855, 2868, 2871, 2878, 2879, 2886, 2889.
METALS, including apparatus for their manufacture, 2859, 2872.
CHEMISTRY AND PHOTOGRAPHY, 2856, 2881, 2882, 2894, 2895.
ELECTRICAL APPARATUS—*none.*
WARFARE, 2875, 2897.
LETTER-PRESS PRINTING—*none.*
MISCELLANEOUS, 2852, 2858, 2860, 2862, 2865, 2876, 2892, 2896.

2851. J. T. STROUD. *Improvements in lamps for general and special purposes, and in parts connected with the same.* Dated October 23, 1862.

This invention has reference to a previous patent, dated July 28, 1862, No. 2140, and consists, under one modification, in supplying moderator lamps with oil or fluid for supporting combustion through a supply pipe conveniently placed at the top, having a plug fitted to the same, and which plug the patentee makes hollow, for the purpose of introducing a float consisting of a cork, or other light suitable material, attached to a small vertical wire, which passes through a cross-piece in the neck of the tube for receiving the plug before mentioned, allowing the float to rise when full. The details are voluminous. *Patent completed.*

2852. W. S. GAMBLE. *An improved salinometer.* Dated October 23, 1862.

This invention is carried out in practice as follows:—Within a metal case the patentee adapts a large glass tube, the lower edge of which rests on a flange, to which it is fixed water-tight, the upper edge of the said tube being held in position water-tight by means of a short hollow casting, and a screw cap tightening thereonto. The aforesaid metal case is made as a double cylinder, or two cylinders one within the other, the outermost cylinder having a long opening therein for reading off the indications of a hydrometer placed within the aforesaid glass tube. An important feature of this invention consists in forming the bulb of the hydrometer with points around and about its largest diameter, the scale of the salinometer being so adjusted to read off from the bulb of the hydrometer, instead of from the surface of the water, as heretofore practised. Another feature of this invention consists in employing a three-way cock, instead of two separate cocks, as ordinarily practised; by these means the operation of blowing may be performed direct through the three-way cock aforesaid, instead of blowing through the salinometer, as heretofore practised. He also proposes to adapt a piece of wire gauze to the bottom of the large glass tube containing the hydrometer, and by placing a cap on the top of the salinometer, ebullition of the water is almost entirely obviated, and the water is thus kept clear, by which the reading of the scale may be more readily and accurately accomplished than by the use of salinometers as heretofore constructed. He proposes to adopt a thermometer within the salinometer visible from the outside. He also proposes to adapt a small valve with a fine thread or screw cut about its stem for adjusting the extent of the opening of the induction passage of the three-way cock aforesaid, leading from the steam boiler into the salinometer, an eduction passage being formed within the case of the salinometer, extending from the top to the bottom thereof to carry off the water into the waste pipe. *Patent completed.*

2853. A. CHAPLIN and G. RUSSELL. *Improvements in obtaining fresh water by evaporation, and in apparatus therefor.* Dated October 23, 1862.

This invention consists in employing what may be termed the "jet" action of the steam when passing towards or into the condensing worm or other condenser, to draw in and thoroughly intermingle with itself sufficient atmospheric air to combine with the water of condensation, and impart to it the well known "fresh" character which distinguishes spring water from ordinary distilled water. *Patent completed.*

2854. J. TURNBULL. *Improvements in mills for grinding grain.* Dated October 23, 1862.

This invention relates to that class of mills for grinding grain known as vertical mills; that is to say, the bed or stationary stone is placed on its edge, and the grinding surface therefore in a vertical position, while the running stone is mounted on a horizontal axis, its face being brought up parallel to the face of the bed-stone. The patentee places the bed-stone to about half its thickness into a cast-iron box or case, which encircles and fits it somewhat closely, and bolts fixed with lead on the stone project through the holes in the disc of the case, over which are mounted bridge pieces fixed on the case; the screw parts of the bolts pass freely through these bridge pieces, and are held by nuts on each side of such bridge frames, by which means the position of the bed-stone can be adjusted at will. The shaft on which the patentee mounts the running stone passes quite through the bed-stone, and is supported at that end by a bearing formed in a cast-iron boss fitted in the eye of the stone; or the shaft may pass freely through the end of such boss, and be supported by an independent bearing. The boss fitted in the eye of the bed-stone is cylindrical, and considerably larger than the shaft which occupies the centre, in order to receive an archimedian screw, which carries the feed through the bed-stone, and up to the face of the running stone. The screw is fixed on the shaft, and therefore rotates with it. The feed is delivered by a spout into a small hopper or shoot made on the back end of the boss, which conducts it to that end of the screw. The cylindrical boss is bolted to the case receiving the bed-stone. The hopper receiving the grain in bulk is in suitable position, and has a slide to regulate the passage of the grain, which passes from thence by a spout or shoot to the boss hopper before mentioned. This shoot is fitted with what the patentee terms a spring bottom, being a sheet of metal by which the upper end is attached; it is suspended towards the other end by a rod furnished with a regulating screw and nut. Immediately below the shoot bottom, he mounts a tappet piece on the stone shaft, which projects through the stone boss, as before mentioned. The tappet has two, three, or more points of contact which strike the bottom of the shoot, and cause the grain to pass regularly down the shoot, whereby a regular supply of grain to the stone is ensured. *Patent completed.*

2855. W. CLARK. *Improvements in sewing machines.* (A communication.) Dated October 23, 1862.

This invention consists, in part, of a novel mode of controlling the needle thread of the sewing machine, whereby the quantity delivered to the needle is caused to be always in proportion to the thickness of the cloth or other material being sewed, and the length of the stitches to be made, and a uniform tightnness of stitch is produced, whatever variation may occur in the thickness of the material, or however the feed motion may be varied, obviating entirely the necessity of any manual adjustment by the operator for sewing material of different thickness. It also consists in an improved mode of applying the locking thread spool or bobbin in combination with the rotating hook of what is known as the "rotating hook sewing machine," whereby a much larger bobbin or spool can be used than by the modes of construction heretofore adopted. Also in a loop check of novel construction, operating to check the loops of the needle thread in their passage over the rotating hook without aid from any other part of the machine, and serving also to hold in position a spool case which contains the locking thread. Also in certain improvements in the feeding device, whereby it is better adapted to the feeding of work of varying thickness, and made to work with little noise. And it further consists in certain improvements in the construction of the thread spools for containing or carrying the thread used, or to be used, in sewing machines, whereby they are made to occupy very little room, and to contain a large quantity of thread in a very small compass, one object of this improvement being to have the thread spooled by the manufacturer in a form suitable for use as the locking or lower thread in the rotating hook sewing machine without the necessity of rewinding or respooling. *Patent completed.*

2856. E. Bath. *Improvements in treating alkali waste to obtain sulphur therefrom.* Dated October 23, 1862.

The principle on which this process is based is the mutual decomposition which takes place when sulphurous acid gas and sulphuretted hydrogen are brought into contact, water being formed and sulphur being precipitated. The operation is conducted as follows:—The sulphurous acid is produced by the calcination in muffle calciners of either copper or iron pyrites or coarse regulus, or by the burning of sulphur. The sulphuretted hydrogen is produced from the waste products of alkali manufacture, viz., alkali waste and hydrochloric acid; by the addition of the latter to the former sulphuretted hydrogen is evolved, and chloride of calcium remains in solution. The two gases, viz., sulphurous acid and sulphuretted hydrogen are caused to enter at the bottom of a tower filled with round smooth pebbles, through which water is caused to percolate, the two gases on meeting are decomposed, and sulphur is precipitated in a finely-divided state. The action of the water is as follows:—By its means the tower is kept at a low temperature, and the finely-divided sulphur as formed is brought out, and thus the tower is kept in a continuous working state, and clogging is prevented, without the necessity of stopping the process to remove the accumulated sulphur. The water also acts as a sort of reciprocating balance between the two gases, as whichever may be in excess for a time is absorbed by the water and retained until the just combining proportions of the two gases are restored by the workman. The water also furnishes an index of the proper working of the process, as whichever gas may be in excess is apparent at once by the smell of the water. *Patent abandoned.*

2857. M. C. A. Perkes. *An equilibrium double action revolving rudder, self-balancing drag, and improved steering gear.* (A communication.) Dated October 23, 1862.

In carrying out this invention, the inventor constructs the rudders of double their ordinary widths, and inserts the rudder post in the middle, which thus forms a central shaft or axis, on which the double bladed rudder is made to revolve when in use. The foot of this central shaft is supported on proper bearings from the keel, and the stern of the ship is slightly undercut or recessed, so as to receive the rudder and allow it freely to revolve as described. The upper portion of the central shaft is continued through a well hole to the deck in the ordinary way, and supported by proper bearings made portable, by preference, so as to be capable of immediate removal for any required purpose. On the top of this shaft is fixed a horizontal spur wheel, which is set in motion by a suitable pinion, and which pinion is attached to the foot of a vertical shaft, rotating in a suitable frame, which is fixed on the ship's deck for the purpose of supporting the steering wheel. He prefers to use the steering wheel horizontally for giving motion to the rudder, but a vertical steering wheel can be applied, by using mitre or bevel gearing to convey the motion to the rudder whenever required. On the upper side of the horizontal tiller wheel, as fixed on the top of the rudder post, he provides an indicator of similar form to the rudder, and paints it some conspicuous colour with points exactly to correspond with its direction, so that the true position of the rudder can always be seen on deck. The steering wheel he also provides with one or more suitable fastenings, so that it may be instantaneously and securely locked in any required position. *Patent completed.*

2858. H. Rek. *Improvements in apparatus for exercising the human body.* Dated October 23, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2859. H. Donald. *Improvements in machinery or apparatus for bending or straightening metal plates.* Dated October 23, 1862.

This invention relates to the arrangement and construction of machines or apparatus for bending or straightening the metal plates used in shipbuilding, and for other generally similar purposes. Under one modification, the machine consists of a pair of cast-iron end standards, connected by horizontal tie rods. Each end standard is made with a rectangular opening in it, the vertical faces of which are grooved to receive a sliding block. These blocks carry the bearings of a heavy roller, which, in machines of the ordinary kind, serves as the bending roller, but in this modification it is not used for that purpose. Below this roller is arranged another roller of smaller diameter, which is used for the bending of the plates. This roller being of comparatively small diameter, plates can be circled to a much smaller diameter than can be accomplished with the ordinary bending machines. This improvement is very advantageous for bending mast plates, or other similar forms. The small roller is arranged to work in frictional contact with the upper roller, and this arrangement prevents it springing when bending heavy plates. Below the smaller roller are arranged two other rollers parallel to each other, their peripheries extending out beyond the smaller roller. These rollers are driven by means of suitable gearing, and they serve to guide and carry the plates in either direction under the bending roller. The peripheries of the pair of rollers are indented or grooved longitudinally, one face of the indentation forming a vertical line, whilst the other is bevelled off until it merges into the periphery of the roller. With this arrangement, when a plate is passed into the machine to be bent, its front edge glides into one of the indentations without the noise or shock which takes place when the grooves have two vertical faces, as in the ordinary arrangement. The bending roller is fitted on two moveable brushes, so that by removing these the bending roller is lowered, and its peripheries then rest on the pair of grooved rollers beneath. In this position the bending roller and the upper roller may be used for straightening plates. The distance between the two rollers is regulated by causing the sliding blocks which carry the upper roller to traverse up and down. *Patent abandoned.*

2860. E. H. Carbutt and G. A. Clough. *Improvements in power hammers.* Dated October 23, 1862.

This invention relates to certain improvements in steam hammers, whereby they are rendered self-acting, the length of stroke being adjustable in either direction. According to one method of carrying out this invention, an inclined groove or its equivalent is made to communicate with a bowl sliding in a transverse groove on the hammer frame through a lever of the second order, or any other mechanical expedient by which the patentees can gain their object - namely, giving the inclined groove first referred to very little deviation from the vertical in proportion to its length, and gaining the travel they lose in the incline by the lever or its equivalent in connection with the bowl, which transmits its motion to the valve through wedges made adjustable by screws or levers on a special moveable frame in connection with the valve. One of these wedges has means provided by which its pitch or inclination can be regulated. This adjustment regulates the amount of steam supplied to the cylinder; or the steam can be entirely shut off from the upper side of the piston. The moveable frame admits (as also does the means of gaining travel) of many modifications. By another method, they render steam hammers self-acting by causing the steam actuating the hammers to move the valve directly. According to the second part of the invention, they propose to form steam hammers known as single-action hammers in a peculiar manner. They form the tup cylindrical, and of a diameter in proportion to the size of hammer. Means are provided on the said tup at its upper end for attaching a wrought-iron or any other metal cylinder to it. The annular space thus formed between the tup and the cylinder attached to it is occupied by the main piston, which is a fixture, and is attached to the hammer frame. They also substitute for the present steam valve a pendulous one, where the exhaust passes outside the case or through the valve, while the outside of the valve is surrounded with steam. *Patent completed.*

2861. J. Field. *Improvements in steam engines, condensers, and boilers.* Dated October 23, 1862.

This invention consists—1, in an improved method of adapting a high-pressure cylinder, on Woolf's system, to the ordinary double piston rod arrangement of horizontal steam engines. The inventor places the small or high-pressure cylinder concentric with the large cylinder, and immediately in front of it, between it and the crank shaft, the two piston rods from the large cylinder pass, one on either side of the small one to the crosshead on either side of the crank shaft, with a connecting rod returning to the crank in the ordinary way; the piston of the small cylinder is connected to the large piston by a rod passing through a steam-tight joint between the two cylinders. This arrangement allows of the covers of either of the cylinders being easily taken off when required for examining the pistons and otherwise. 2, The invention consists in an improved form of surface condenser, so as to enable the tubes to be readily inspected and cleaned. He places the condensing tubes in a position inclined from the horizontal line, with covers forming chambers at each end; the exhaust pipe from the cylinder is brought into the chamber at the highest end of the tubes, and the condensed water is delivered into that at the lower end, from which it is conveyed to the air-pump. This arrangement leaves the ends of the tubes conveniently exposed, when the covers are removed so as to be readily cleaned when required. And 3, The invention consists in adapting the ordinary description of tubular boiler with return tubes over the fireplaces for using a higher pressure of steam than can be safely used in a rectangular boiler, however stayed. He places the fireplace, which is cylindrical, inside a cylindrical outer case, and also places another cylindrical case above it of sufficient capacity to contain the requisite number of tubes; these cases are connected together at the back by a chamber which contains the rising flue leading from the fireplace, and which can be stayed in the ordinary manner to bear the requisite pressure. He also forms a water connection at the forward end of outer cases, in order to keep up a proper circulation in the boiler. One or more fireplaces may be placed in the lower cylindrical case leading into one rising flue, as may be most convenient. Any number of these boilers may be placed together and connected so as to be worked together or separately. *Patent completed.*

2862. R. A. Brooman. *Improvements in tanning.* Dated October 23, 1862. (A communication.)

This consists in the employment of pressure to cause the tannin to penetrate into the pores of the hides. The apparatus employed is not described apart from the drawings. *Patent completed.*

2863. A. J. F. V. Beepson. *A syphoidal cistern with water reservoir for kitchen or other drains in communication with infected sewers.* Dated October 24, 1862.

The apparatus or contrivances in use for running off kitchen or other refuse waters in private dwellings or public establishments permit bad smells to escape, or require to be opened when used either with a key or lever, giving, whenever opened, issue to fœtid odours. The syphoidal cistern or trap with water reservoir and hydraulic shutting or closing, the subject of the present invention, is intended to prevent the said inconveniences. It is composed of a basin kept constantly full of water to submersion to its top edge, so that, on pouring any more in, the pressure causes the level to rise, and the overflow takes place through large vent holes or outlets suitably disposed, and the waters run off, leaving the basin always full to the same level as before. This very simple apparatus prevents the rippling of the water when falling from a spout into the basin, and at the same time intercepts any fœtid emanations or efflux. This apparatus can be adapted with suitable modifications of arrangement to any places, such as kitchen drains, kennel gratings, cesspools, or sink holes of drains in which run filthy or infected waters. The basin is hermetically closed at its lower part, and the overplus of water, having no escape hole, cannot run out but by raising its level to the vent holes or purging outlets, which are hermetically closed themselves at their top within the apparatus by a bottomless basin, the lower edge of which dips in a circular drain or groove. The nauseous efflux could not thus penetrate to the places which are to be preserved therefrom, except by running through a deep bed of water, which is not possible. *Patent completed.*

2864. C. C. Burmeister and W. Wain. *Improvements in the construction of cupolas, and in apparatus connected therewith, for naval or other war purposes.* Dated October 24, 1862.

The shield or exposed parts of cupolas for protecting guns and gunners, the inventors prefer to construct entirely of metal, by preference iron or steel, in one or more layers or thicknesses, and of hemispherical form. The shield has a series of ports formed around it, suitable for the muzzle of the gun to pass through, each port being furnished with doors or slides to close or open the same when required: and other port holes may if desired be formed in the shield suitable for hand-rifle firing. The crown of the shield is covered by a perforated metal plate to afford protection and ventilation, and rotary movement is communicated to the shield by suitable mechanism, actuated by hand, steam, or other motive power, the whole being mounted so as to rotate around a central hollow axis. An inverted hollow ring is fixed on the outer circumference of the cupola or shield near its base, which overlaps the vertical rim of another ring fixed on the deck or floor of the battery, in order to prevent the introduction of gunpowder or other explosive or destructive matters. The gun or its platform may be arranged to rotate on a central pin or axis within the shield independently thereof, if desired. *Patent abandoned.*

2865. L. Groux. *Improvements in the manufacture of soap, and in machinery for that purpose.* Dated October 24, 1862.

The patentee claims—1, Mixing plain and coloured soaps, either separately or together, whilst cold, or mixing colouring matters or perfumes therewith whilst the soap is in a cold state. 2, The use of cylinders and pistons for mixing soaps whilst cold, and further, making the outlet pipe at which the soaps are forced out in the form of a star or other shape, as described. 3, Mixing together hot and cold soaps of different colours in vessels as described with reference to the drawing. *Patent completed.*

2866. J. Ginson and R. Flude. *Improvements in looms for weaving narrow fabrics.* Dated October 24, 1862.

This invention relates to those kinds of looms in which the shuttles are thrown either by toothed pinions working in racks, or by what are known as peg motions. The first improvement relates to a novel mode of actuating these drivers, whereby the shuttles are passed through the sheds, and consists in actuating these drivers by means of levers which are vibrated by causing their inner ends to work in a cam groove formed in a barrel, drum, or cylinder mounted on any convenient rotating shaft belonging to the loom. By this means a smoother and less noisy motion is imparted to the drivers than that produced by the use of treadle levers with chains, cords, or bands, as is now generally the case. The next improvement relates to the peg motion, and instead of fixing the pegs immoveably on the drivers, they are made moveable therein in a vertical direction so that they may be moved up and down for the purpose of being inserted into or withdrawn from the holes in the shuttles. *Patent abandoned.*

2867. J. R. Nicholl. *An improved construction of fire-place or stove-grate.* Dated October 24, 1862.

The object of this invention is to supply coals to open fire-places or stove-grates, in such a manner as to economize the consumption of fuel and to check or prevent the formation of smoke. To this end the inventor fits up the fire-place or stove-grate with a sliding back, which may be advanced or pushed back at pleasure, and in front of this back he hangs a swing plate which has a tendency to take an inclined position, and form with the sliding back a kind of temporary hopper or shute. When the fire is burning brightly in the grate, the back will be in an advanced position, and the swing plate will be retained by the sliding back in a vertical position; but when a supply of coals is required, the attendant will thrust the sliding back (by a rod, rack and pinion, chain and pulley, or other convenient means) to its furthest backward position, and thereby leave the swing plate free to take the inclined position. This plate he so shapes, that when inclined and forming with the sliding back as above stated a hopper or shute to receive a charge of coals, an opening will be presented for the coals to descend into the grate at the back of the burning fuel. This being done, the attendant draws forward the sliding back, which, now acting as a plunger, forces the fresh coals under the incandescent fuel in the grate. The gases therefore evolved from the fresh coals will pass through the incandescent fuel and become consumed. *Patent abandoned.*

2868. J. Wright. *Improvements in the construction of seamless stays.* (A communication). Dated October 24, 1862.

The object of this invention is to produce a seamless stay, not only more perfect in form, but formed of materials not only of different colours, but of different compositions, so as to be suited for wearing in different seasons according to the temperature. For this purpose the inventor substitutes for the present materials forming the lining and facings of woven corsets a material of elegant reps, similar to those used in making gobelins designs; from this lining or covering which has the warp removed, he weaves the woof in wool of all sorts of textile materials, and of different colours. *Patent abandoned.*

2869. J. T. Shroud. *Improvements in the manufacture of, and in the machinery and appliances for, holding, drilling, turning, tapping, fitting, and shaping certain parts of steam, water, gas, and lamp fittings.* Dated October 24, 1862.

We cannot here give space to the details of this invention. *Patent abandoned.*

2870. P. S. Devlan. *Improvements in the manufacture of bearings, steps, axle boxes, and other surfaces and appliances or articles subjected to friction.* Dated October 24, 1862.

The object of this invention is to form bearing surfaces and linings, packings, or internal fittings for axle boxes and steps, and to produce other surfaces or articles subjected to friction. For these purposes he uses asbestos, or other mineral fibrous substance, combined with a gummy, glutinous, feculous, or albuminous substance, or other substance capable of rendering it cohesive. *Patent completed.*

2871. G. and W. Luke. *Buckle eye stirrups.* Dated October 25, 1862.

This invention is applicable to all kinds of stirrups, in whatever metal they may be made, and consists in doing away with, or rendering unnecessary, the buckle used with the ordinary stirrup-leather, and substituting for it a moveable tongue or pin of iron, steel, or other metal fitted into, on, or upon the upper or lower bar of the eye or loop in the stirrup itself, so as to provide for the shortening, lengthening, or fastening the stirrup-leather when or as required. *Patent completed.*

2872. J. Carpendale. *Improvements in the means of producing raised chasing on Britannia and other compressible metals.* Dated October 25, 1862.

This invention consists of a mechanical contrivance, by which the mode of producing raised chasing by mere manual pressure, hitherto partially resorted to, is superseded, and the use of steel plates or dies, with the negative of the ornament to be impressed on the metal engraved or cut therein, is made practically available. The first motion from the driving shaft is applied to drums in the usual manner, on the axis of which is fixed a disc of wood or other material, in which the steel plate or die is embedded. Parallel to the face of this disc a slotted guide is placed, in which a block containing the pressing tool is fixed; the block is moved in the slotted guide by a screw with a crank handle, and another screw acts upon the head of the pressing tool. Upon the face of the steel plate, cut or engraved with an appropriate design, the metal to be operated upon is fixed, and the pressing tool screwed upon it with such amount of pressure as may be necessary to produce a true positive impress of the design cut in such plate or die. *Patent completed*

2873. W. Owen. *Improvements in stoves.* Dated October 25, 1862.

This invention relates—1, To what are known as register stoves—viz., such as are furnished with a door opening into the chimney, and it consists in fitting below or in front of such door and independent of it a frame of louvre plates. This frame moves as upon hinges, and is capable of being thrown entirely back to allow of uninterrupted access to the chimney. The invention relates—2, To those stoves known as air stoves, and consists in forming them with radiating chambers instead of with solid plates, as heretofore. *Patent completed.*

2874. G. T. Key. *Fog and other signals.* Dated October 25, 1862.

This invention consists in the application of bellows to sound a wind instrument (such as a foghorn, the horn forming the spout of the bellows), or two or more differently sounding wind instruments (as, for example, a foghorn and whistle) for signalling during fogs and at other times. The bellows may be made either single acting, double acting, or continuous acting. *Patent abandoned.*

2875. D. and W. Brown. *Improvements in rolling machinery for rolling gun barrels, cannons, and other articles.* Dated October 25, 1862.

This invention consists in driving or actuating the rolls of rolling machinery by so constructing and arranging the driving gearing that an intermittent rotary motion is communicated to the rolls, the said rolls being brought to rest at the proper times for the purpose of permitting of the ready introduction of the gun barrel or other article between the rolls. *Patent abandoned.*

2876. J. A. Nicholson. *Improvements in lead, crayon, and other pencils.* Dated October 25, 1862.

This invention consists in forming grooves longitudinally or otherwise from end to end in those articles, for the purpose of removing a considerable portion of the material of which they necessarily consist, in order to render them more easily pointed than when left solid as usual. *Patent completed.*

2877. W. Clark. *An improvement in the construction of the joints of cast-iron gas and water mains, and other pipes.* (A communication.) Dated October 25, 1862.

This invention consists in making such joints by forming grooves or recesses around the interiors of the sockets or larger ends of the pipes, making the smaller ends slightly taper, casting rings of lead or other soft metal or alloy within the aforesaid grooves or recesses before putting the pipes in the ground, or into the places they are to occupy, and afterwards drawing or forcing the taper smaller ends tightly into the aforesaid rings, by which means a tighter, more durable, and more flexible joint is obtained than by the ordinary construction, with a great saving of lead or other soft metal or alloy that may be used, and the pipes are enabled to be laid more expeditiously. *Patent completed.*

2878. A. Clark. *Improvements in the construction of bows and pendants of watches.* Dated October 25, 1862.

In carrying out this invention, the inventor proposes to form the ball of the pendant of the watch in three divisions; the lower division of which is a fixture on the pendant, the central division being a swivel, and the upper division cut with a screw thread, or fixed on to the pendant by hammering or enlarging the head of the latter. The bow of the watch is to be attached to the swivel or central division of the ball by its insertion therein, and by a pin or a nut, or other fastening adjusted thereto. *Patent abandoned.*

2879. P. Alfraise. *Improvements in sewing machines.* Dated October 25, 1862.

This invention relates to sewing machines, both of the shuttle description and other kinds. The first improvement consists in actuating the needle-carrier by a jointed frame or parallelogram, which consists of four jointed or articulated levers, bars, rods, or arms, and acts as the tension piece for giving the tension to the thread. By this arrangement the noisy gearing in present use is dispensed with. The second improvement consists in the employment of a cam or an eccentric, or a round plate or disc, on which is a groove or grooves, or slot or slots, in the form of a volute, for the purpose of actuating the parallelogram or jointed frame. The third improvement consists in combining a pulley or wheel with a stationary eccentric or cam, whereby the inventor obtains the stopping interval of the needle while the shuttle is passing. The fourth improvement, which is applicable to glove-sewing and other descriptions of sewing machines, consists in communicating to the needle-carrier, in addition to its to-and-fro motion, a shifting motion, or motion whereby it shifts or changes its position at each stroke of the needle, in such manner that the stitches come in two rows a short distance apart, the direction of the rows being in parallel right lines, or side by side, but the stitches falling alternately or intermediately. *Patent abandoned.*

2880. T. G. Ghislin. *Improvements in the treatment and utilization of certain foreign plants for the obtaining of useful fibres therefrom.* Dated October 25, 1862.

This invention relates to the obtaining from a class of bulbous plants of the Liliaceous and Amaryllidaceous Orders fibre suitable for spinning into yarn, and for being converted into paper pulp. In order to obtain the fibre suitable for spinning, the patentee takes the ball (if in a fresh state) and boils it in water, or water rendered slightly alkaline, until the resinous matter contained in the plant is dissolved and the bulbs have become soft. The soft pulpy mass thus obtained is then submitted to pressure in a press, in order to expel therefrom the liquid, together with whatever has been dissolved, and he thus obtains the fibre in a matted state. If preferred, the expulsion of the liquid may be effected by means of centrifugal apparatus, as is well-known. He next washes the fibre, and for the purpose of opening it out subjects it to the action of steam at a suitable pressure, after which he dries the fibre by exposure to the air, or in a heated atmosphere. The fibre thus obtained he proposes to card, draw, and spin in the usual way. When the bulb is dry, he strips off the outer cuticle, and, by preference, boils the bulb in an alkaline solution, and he afterwards neutralizes the alkali by weak acid. He next subjects the fibre to a bleaching process, using either gaseous chlorine or chloride of lime, or any other material commonly used for this purpose. He then removes the bleaching agent by washing, and afterwards removes the moisture from the fibre by means of pressure or centrifugal apparatus. He then again washes the fibre in water, opens it out by steam, and drys by exposure, as in the former instance. *Patent completed.*

2881. E. A. L. Negretti and J. W. Zambra. *Improved apparatus for ascertaining or testing the explosibility of liquid hydro-carbon.* (A communication.) Dated October 25, 1862.

This apparatus consists of a thermometer, the bulb of which is made to dip into a cup or vessel in which the hydro-carbon to be tested is placed, and is heated by a spirit lamp or water bath beneath. Upon the hydro-carbon being heated, it will give off vapour in proportion to its volatility and the heat employed, and this vapour, after being allowed to mix with a certain proportion of air in a suitable chamber or vessel, will form an explosive compound. Upon introducing a flame into the chamber or vessel where the mixed gases are, a slight explosion will take place if the proper proportion of gases are there. After the first explosion, the exact time required for evolving a sufficient quantity of vapour to produce a second explosion must be noted, the temperature of the hydro-carbon must also be ascertained by referring to the thermometer. By this means the lowest temperature at which the hydro-carbon will form an explosive compound will be indicated by the thermometer. *Patent abandoned.*

2882. J. P. Bourquin. *An improved manufacture of mount for photographic and other albums, miniatures, and other pictures.* Dated October 25, 1862.

The object of this invention is to manufacture mounts that will not soil with the touch, and which when dirty may be readily cleansed without injury thereto. This the inventor proposes to effect by substituting veneers of choice woods for the card-board facings of mounts, which veneer facings will admit of being French-polished, and of receiving various kinds of ornamentation. In making album mounts he first backs leaves of veneer with paper or cloth, and then cuts out the openings for the pictures. He next places two leaves back to back, so that the openings in each shall correspond, and applies card-board filling at certain parts, so as to leave space between the leaves of veneer for the insertion of the photographic or other pictures, as is well understood; then, by glue or other cement applied to the filling pieces and leaves where in contact therewith, he connects the leaves of veneer together. *Patent abandoned.*

2883. J. Chattwood. *Improvements in ventilating rooms and cellars.* Dated October 27, 1862.

This invention has for its object the ventilation of rooms and cellars, the equalizing of temperature, and the prevention of inconvenient drafts or currents in rooms containing fires. To accomplish this the patentee makes the bars of the grate or fire-holder hollow or tubular, and perforates the said bars with any convenient number of holes or apertures; or he makes the sides of the grate or fire-holder, or the jambs or sides of the fire-holder, with chambers or cavities, and places any convenient number of perforations or apertures therein for the air to pass through. The air is supplied to the said bars, chambers, or cavities from the cellar or room to be ventilated by means of apertures, channels, or pipes, as may be required. He also admits the air to the said bars, chambers, or cavities, when required, by means of pipes or channels communicating directly with the external air outside the building. He also uses where convenient a hollow cone or cones, or other shaped figure or figures, containing any convenient number of apertures or perforations, and places the same near the fire, and in communication with the external air or the room to be ventilated. A valve or regulator is placed in any convenient part of the said pipes or channels for the purpose of regulating the quantity of air passing through the said channels, pipes, or apertures. The said apertures or perforations are made of any convenient part of the before-named portions of the apparatus, but he prefers to place them in such a way that dust or ashes may have little tendency to choke or stop the free passage of air. *Patent completed.*

2884. J. H. Johnson. *Improvements in rotary engines.* (A communication.) Dated October 27, 1862.

This invention relates to a peculiar construction and arrangement of rotary engine, wherein a continuous rotary motion is obtained by the successive direct action of a number of cylinders and pistons upon two discs placed at an angle with each other; and consists in the employment of a pair of discs, one of which has a number of steam ports cast therein, and each disc is fixed on one end of a separate shaft of its own. In place of the two shafts being in the same axial line with each other, they are placed at an angle, so that the peripheries of the two discs will be nearer together at one side than the other. The steam ports or passages communicate by means of flexible pipes with corresponding single-acting cylinders, connected by ball and socket joints with the inner face of one of the discs, the corresponding pistons and rods being similarly connected to the inner face of the opposite disc. A valve in the centre of the disc is so arranged as to admit the steam into each port successively as the discs revolve, the steam entering that port and cylinder which is situate at the point where the edges of the discs are nearest together. As the steam expands, the cylinder and piston tend to separate by their joint action upon the inclined surfaces of the discs, and tend to rotate the same, bringing the next succeeding port and cylinder under the valve, which then receives steam in its turn, and so on; the exhaust taking place through another passage in the valve at a point where the action of the cylinder and piston is no longer of service. Motion is transmitted from these discs by having spur teeth cast thereon gearing into corresponding pinions on a second motion shaft. The bearings which support the shafts of the two discs wheels are made adjustable on their tables so as to regulate exactly the angles of two shafts. *Patent abandoned.*

2885. J. H. Johnson. *Improvements in heating glass furnaces.* Dated October 27, 1862. (A communication.)

This invention relates to an economical mode of heating glass furnaces of all kinds, and consists of an arrangement for employing for that purpose the waste gases from coke ovens. In carrying out this invention, the gas emitted from the coke ovens is conveyed by suitable passages or flues into a fire-brick depositing chamber, where heavy cinders or heavy matter carried over are deposited, the current of the gas being retarded by having a division wall extending downwards to near the bottom of the chamber, under which partition the gas has to pass before it can escape. A syphon pipe opens into one end of the depositing chamber at the top thereof, and communicates with the upper part of a condenser. This condenser consists of a metal vessel having an expanded tube fitted to the under side of the cam, and reaching down to near the bottom of the vessel, the largest diameter of this tube being at the lower end, whilst its smaller end opens direct into the second mouth of the syphon pipe. A rose jet is contained inside the expanded tube, and is supplied with water from a cistern above, so that as the gas passes from the depositing chamber it is cooled by passing through the stream of cold water, and, the tar being condensed, falls to the bottom of the vessel. From the upper part of this vessel the gas freed from the tar passes through pipes to the glass furnace, previous to which it is heated and mixed with a blast of air, and directed through tuyeres into the chamber of the furnace containing the glass. *Patent completed.*

2886. H. C. R. Joubert, *Improvements in raising music chairs, stools, or seats, which entirely supersedes the original screw now in use.* Dated October 27, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2887. F. Lipscombe. *Improvements in purifying water.* Dated October 27, 1862.

This invention relates to the treatment of vegetable matter preparatory to its conversion into charcoal for filtering purposes. According to this invention, the whole or portions of any tree or shrub is or are cut into small pieces, and steeped in a strong solution of caustic soda, or caustic potash, or a combination of the two, in any proportion, for several days. The aforesaid pieces are then taken out of the solution, dried, and converted into charcoal in well-covered crucibles, or otherwise. The charcoal is afterwards ground and treated in the usual manner. It may then be used by itself, or in combination with one or more plates or slabs of porous stone, or with ordinary charcoal, or in combination with one or more of the materials which are used by filter-makers as filtering media for impure water to pass through. *Patent completed.*

2888. W. J. WILLIAMS. *Improvements in the construction of field-rakes for agricultural purposes.* (A communication.) Dated October 27, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2889. T. PILGRIM. *An improvement in locks, bolts, atches, and other fastenings.* Dated October 27, 1862.

This invention consists in the addition of a supplementary gravitating or spring lever and bolt fixed to, in, or upon an ordinary lock, so as to be actuated simultaneously with the bolt or latch of such lock, and with the same key, such key being formed with an additional limb for actuating the said supplementary bolt or latch. The supplementary bolt or latch can be added to locks, latches, and spring bolts as at present fixed to any door, chest, or other enclosure. Locks thus constructed, or to which this improvement is added, cannot be opened without the proper key, or a duplicate thereof. When the addition is made to existing locks, the limb for actuating the supplementary bolt can be added to the ordinary key. The bolt of an ordinary lock, fitted with this improvement, cannot be actuated without locking or unlocking the supplementary or safety bolt. *Patent completed.*

2890. F. L. H. W. BUNGER. *Improvements in self-acting apparatus for discharging the water resulting from the condensation of steam.* (A communication.) Dated October 27, 1862.

This invention consists in adapting to vessels wherein steam is used the employment of certain self-acting mechanism, whereby the water produced by the condensation of steam is more easily got rid of than has heretofore been the case, at the same time preventing the escape of steam. To effect this, the inventor places within a pipe in connection with the steam vessels a tube or pipe of smaller diameter filled with water, and closed or solid at one end, whilst at the other end it is closed by means of a disc or plate of india rubber or other suitable elastic material fixed in any convenient way, so as to make it perfectly water-tight. He places inside the pipe in connection with the steam vessel a valve seat. The lower end of this pipe is fixed to a cistern. To the inside of this cistern he attaches a bracket or stop. On the tube or pipe of smaller diameter he attaches a valve or lid. The lower end of this tube on which the india-rubber disc is fixed rests on the bracket or stop above mentioned. *Patent completed.*

2891. J. J. RIDGE. *Improvements in treating certain farinaceous substances applicable to infants' or invalids' food, and in appartus to be employed therein.* Dated October 27, 1862.

This invention has reference to an improved process for treating and imparting medicinal properties to wheaten flour, oatmeal, Indian corn, rice, or like farinaceous substances, and obtaining therefrom a purer and more nutritious food, applicable to infants or invalids, than at present, and consists in subjecting the said farinaceous substances to a roasting or drying process, contained within closed cylindrical vessels or chambers surrounded by and maintained under heat uniformly for about six hours at the temperature of boiling water, steam, or otherwise; suitable outlet pipes or passages in the apparatus being provided for the escape of vapour or gases evolved during the process. The ingredients thus prepared are then to be mixed or incorporated with other matters of an alkaline or saccharine nature, in such proportions as may be found necessary for allaying acidity or otherwise rendering the same soothing and agreeable to the palate. *Patent completed.*

2892. P. E. PLACET. *An improved process of engraving.* Dated October 27, 1862.

In carrying out this invention, the inventor spreads on a clean glass a pretty thick coat of Judea bitumen, which, when desiccated, he exposes, under a stereo or other like plate (cliché), or surface carrying the design to be engraved, in a frame, to the action of light. On being removed from the frame, the impressioned surface is covered with a coating of gelatine, and when dry the whole is plunged in a mixture of naphtha and benzine. The liquid penetrating under the coating removes the soluble parts in contact with the glass, and soon the pellicle of gelatine becomes attached, taking with it the parts which remain insoluble. He transports the sheet of gelatine with the design or figure upwards to a flat surface of glass or metal. If the proof be examined it will be found that the non-dissolved bitumen which constitutes the design or figure will appear in relief, which will be higher the more deeply the light has penetrated. The reliefs are similar to those produced upon a print by the lines in an engraved plate. Then to obtain a plate engraved in intaglio, it is accomplished by taking the mould of this surface in relief; and by having recourse to galvano-plaster, or to the electrotype process, metal plates similar to the mould are obtained, which can be used as in copper-plate printing. *Patent completed.*

2893. G. LINDEMANN. *Improvements in the manufacture of bricks, tiles, slabs, and other articles of earthenware, or other plastic material.* Dated October 27, 1862.

This invention relates—1, to a method of bringing the clay or other plastic material into a condition for being moulded. For this purpose the patentee causes it to be forced through slits or other openings formed around the periphery of a cylinder, and through which it is again propelled, so as to be delivered to any convenient receptacle, or at once into moulds. When the articles are formed by being forced through moulds, and then cut off, he causes them to abut against a surface retained by levers, which, when the material has been severed, turns downward and deposits the moulded article on to a travelling apron, or other such apparatus. Another part of the invention relates to the construction of hoppers for delivering plastic materials to rollers or other apparatus which are to operate upon it, and consists in forming the sides of such hoppers of travelling surfaces. *Patent completed.*

2894. A. PEEK. *Improvements in apparatus for evaporating saccharine and saline solutions.* Dated October 27, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2895. T. RICHARDSON. *Improvements in the manufacture of sulphate of soda.* Dated October 27, 1862.

This invention consists in submitting common or rock salt to an elevated temperature, and employing the same when so heated with sulphuric acid for the manufacture of sulphate of soda. *Patent abandoned.*

2896. J. HOWIE. *Improvements in machinery or apparatus for regulating the supply of solid or liquid bodies to mills, or other apparatus used in mixing or preparing plastic matters.* Dated October 27, 1862.

Under one modification of apparatus, as arranged according to this invention, for preparing a plastic mixture of fire-clay and water suitable for the manufacture of fire-clay goods, it consists of a cylinder in which is arranged a screw. This cylinder is, by preference, placed in a vertical position, and the internal screw is made a little less than the diameter of the cylinder, so as to revolve freely therein, but without allowing the solid matters to pass down between its periphery and the inside of the cylinder. The screw is connected by means of suitable gearing with an engine or other prime mover, so as to impart a uniform rotary motion thereto. The upper part or feeding end of the cylinder being placed in connection with a suitable receptacle of the ground fire-clay, it passes down through the cylinder at a uniform rate, impelled by the motion of the screw, and is carried into the pug mill. The supply of water is regulated by means of a valvular apparatus arranged for the purpose. *Patent abandoned.*

2897. J. CHALMERS. *Improvements in armour plating ships of war and fortifications.* Dated October 28, 1862.

This invention has for its object improvements in armour plating ships of war and fortifications, and consists of the following combinations of iron with timber, or other light and compact substance, or of the arrangement of iron alone, in the manner hereinafter described. The backing for the armour plates to rest against consists of a frame of the following description :—A plate (or plates) of iron an inch in thickness, more or less, forms the bottom of the backing frame, and to the said plate (or plates) are attached longitudinally, vertically, or diagonally ribs of iron half an inch in thickness, and nine inches in width, more or less. The said ribs are to have a T or angle edge for attaching them to the plates at right angles, and they are to be six inches apart, more or less. The spaces between the said ribs are to be filled with timber, or some light and compact substance, so that the timber or other substance will be flush with the outer edges of the ribs, and thus form—with the said ribs and bottom plates to which the said ribs shall be attached with rivets or otherwise—a backing frame for the support of the armour plate. In cases where great strength is required, there are to be cross ribs inserted between and at right angles to the ribs aforesaid, thus forming the backing frame into cells, which may either be left empty or filled with timber, having the grain at right angles to the bottom of the backing frame, or otherwise; or the cells may be filled with some other light and compact substance. But in either case the plate or bottom of the backing frame shall be placed towards the ship or fort, and farthest from the armour plate. In the case of ships or forts built of iron, timber planking of four inches in thickness, more or less, or some other elastic or yielding substance, is to be placed between the backing frame aforesaid and the skin of the ship or wall of fort, in order to lessen the rigidity of the combined bodies. In fastening the armour plates to the sides of a ship or iron fort, the backing frame must be first placed against the ship or fort, and be bolted thereto independently of the fastenings of the armour plates. The armour plates are then placed against the backing frame, and fastened through the backing frame to the ship or iron fort by means of bolts and nuts. The head of the bolt has a stepped conical neck with three steps, more or less, which neck fits into a corresponding hole in the armour plate, so that the shoulders or bearers of the several steps of the neck may prevent the bolt from being driven through the plate when struck on the head by a projectile. *Patent abandoned.*

2898. E. HOOPER. *Improvements in roofiing tiles.* Dated October 28, 1862.

The patentee claims—1, The construction and employment of tiles or slabs having sunken channels upon their upper surfaces free from any rebate, shoulder, or raised portion that would prevent the tiles from lying close together on their general surfaces, which channels are more or less covered by the tile or tiles above them, and having further grooves formed on their under surfaces, which grooves fit exactly over the before-mentioned channels in the tiles beneath, thus forming drips over the same. 2, The construction and employment of tiles having channels and grooves, as ascribed in the first claim, in combination with such a form of the tiles that the meeting corners of two contiguous tiles are cut off, so as to form meeting edges in which notches are made for intercepting the passage of the water, substantially as described. 3, The construction and employment of tiles or slabs, made or cut out of any suitable material, in which those corners that come in contact with other tiles or slabs lying in the same plane are cut off to such an extent as to afford the requisite amount of lap, so as to maintain the external edges of the tiles upon the roof in continuous lines, the particular shape, general formation, and arrangement of the tiles affording at the same time the most efficient covering and protection from the rain, with the least amount of lap, and without the necessity for stopping of any kind, thus ensuring the greatest possible economy in weight and material. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Jan. 8, 1863.

66. R. Groggan, 27, Hereford-road North, Bayswater, W. New and improved propellers for vessels driven by steam or other power.

Dated Feb. 11, 1863.

369. H. Donald, Johnstone, Renfrew, North Britain, engineer. Improvements in machinery for shearing, punching, and riveting metals.

Dated Feb. 18, 1863.

445. J. Platt, mechanical engineer, and W. Richardson, Oldham, Lancaster. Improvements in machinery or apparatus for cleaning cotton from seeds.

Dated March 17, 1863.

715. J. Cox, Georgie Mills, Edinburgh, glue maker. Improvements in swimming baths, and in apparatus for swimming, part of which apparatus is applicable to sailing or moving vessels in a circle.

Dated April 6, 1863.

871. E. T. Hughes, 123, Chancery-lane, patent agent. Improvements in machinery or apparatus for manufacturing the ornamental tips of parasols, umbrellas, and similar articles. (A communication.)

Dated April 16, 1863.

960. A. Samuelson, 28, Cornhill, engineer and iron ship builder. Improvements in the construction and arrangement of machinery and apparatus for the manufacture of oil.

Dated April 17, 1863.

966. J. Goucher, Worksop, Nottingham, ironfounder, engineer, and machinist. Improvements in steam boilers, and in regulating the admission of air into the furnaces of steam boilers.

Dated April 20, 1863.

978. P. G. Rowell, 17, Castle-square, Brighton, Sussex, and H. Holt, 14, Red Cross-street, Brighton, Sussex. A better and more economical mode of securing the bands of locomotive engine and tender springs, also a new method of applying the same.

Dated April 23, 1863.

1012. T. Richardson, Newcastle-upon-Tyne, chemist, and J. C. Stevenson, Jarrow Chemical Works, Durham, chemical manufacturer. Improvements in the manufacture of sulphate of soda.

Dated April 24, 1863.

1016. W. N. Wilson, 144, High Holborn, and J. G. Grey, 97, Cheapside. Improvements in machinery for sewing and stitching.

Dated April 25, 1863.

1034. J. Dunbar, jun., and J. W. Woodford, 12, Sutherland-street, Walworth. Improvements in apparatus for steering ahd manœuvring ships and vessels.

1040. A. Legras, 64, Davies-street, Berkeley-square, confectioner. Improvements in machinery or apparatus for making ices.

Dated April 28, 1863.

1064. W. Clark, 53, Chancery-lane, engineer and patent agent. Improvements in machinery for the manufacture of paper, and of the various kinds of boards produced from fibrous substances. (A communication.)

1066. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in drying and cooling grain, and in the machinery or apparatus employed therein. (A communication.)

Dated April 29, 1863.

1082. M. Barland, Mount-street, Grosvenor-square, and E. H. C. Monckton, Cavendish Club, Regent-street. Improvements in apparatus for withdrawing milk from cows and other mammiferæ, and for conducting it when withdrawn to appropriate receivers. (A communication.)

Dated April 30, 1863.

1090. E. Mitchell, Cams Alders Lodge, Fareham, Hampshire. Improvements in reaping and mowing machines.

1098. W. G. Craig, Cannon-street, engineer. Improvements in feed apparatus for steam boilers. (A communication.)

Dated May 2, 1853.

1100. T. L. Bissell, Charleston, South Carolina, North America. An improved apparatus for charging breech-loading cartridges.

1102. J. W. Gibson, 31, Lower Ormond Quay, Dublin, and W. Turner, Hammersmith Iron Works, Dublin. Improvements in springs to be used for railway buffers, draw-hooks, and also for carrying springs of railway carriages and other vehicles.

1104. J. Purdey, Oxford-street, gun manufacturer. Improvements in breech-loading firearms.

1106. J. B. Dubreuil, 108, Rue du Faubourg St. Denis, gentleman. Improvements in carts, waggons, and other vehicles.

Dated May 4, 1863.

1112. B. G. Sloper, Walthamstow, Essex, engineer. Improvements in apparatus for separating metals from earthy and other matters mixed with them.

1114. F. Applegate, Bradford-on-Avon, Wilts, woollen manufacturer. Improvements in spring balances and pressure gauges.

Dated May 5, 1863.

1118. E. Cheshire, Birmingham, surgeon. Improvements in apparatus for intercepting the solid portions of the soil of water closets.

1120. R. A. Brooman, 166, Fleet-street, patent agent. A new fabric suitable for trimmings. (A communication.)

1122. P. Bradshaw, Earls Barton Mills, Northampton. Improvements in mounting or hanging mill stones for grinding grain and other substances.

1124. W. Glover, South Shields, Durham, ship chandler. Improvements in means or apparatus to facilitate the steering of ships and other vessels.

1126. R. B. Cochran, 48, Flemming-road, Kennington-road, machinist. Improvements in sewing machines, and in apparatus connected therewith.

Dated May 6, 1863.

1123. J. T. Ward, Swansea, Glamorgan, carriage builder. Improvements in carriages.

1130. S. Hibbert, shopkeeper, J. Lawton, smith, and J. Kay, Manchester. Certain improvements in apparatus for cleansing potatoes, and in decorticating the same and other esculent roots.

1134. T. Beesley, Symond's-inn, wine and beer merchant. Improvements in the construction of cases or boxes for carrying and packing bottles.

1136. C. W. Atkinson, 34, Montague-place, Russell-square. An improved steam or other motive power engine.

Dated May 7, 1863.

1138. J. Park, Bury, Lancaster, engineer. Improvements in communicating motion to machinery for manufacturing paper pulp.

1140. P. Bourne, Whitehaven, Cumberland, colliery viewer. Improvements in miners' lamps.

1142. A. Stanley, Walsall, Stafford, covered buckle manufacturer. Certain improvements in the mode of finishing clasps and other such like metallic connectors, and which said mode of finish is also applicable to other purposes.

1144. T. Small, Bargate, Boston, Lincolnshire. Improvements in motive power machinery.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated May 9, 1863.

1163. W. E. Gedge, 11, Wellington-street, Strand. Improvements in the manufacture of paper, stuff, or pulp from certain vegetable substances. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, May 19, 1863.

31. E. B. Keeling. Lighting halls, theatres, and other buildings.

42. C. T. Judkins. New alloys. (A communication.)

43. J. Eckersley. Looms for weaving.

46. J. A. Knight. Printing presses. (A communication.)

48. E. V. Gardner. Treatment of petroleum and mineral oils.

49. J. G. Dahlke. Machinery for cutting clay in the manufacture of bricks, tiles, and similar articles. (A communication.)

54. T. F. Cashin. Covering wire, crinoline steel, or hoops for skirts.

70. R. T. and R. Monteith. Manufacture of dyes from aniline. (A communication.)

75. C. E. Gray. Wringing machines.

86. W. Grove. Apparatus for sawing wood.

87. R. Lüthy. Hydrostatic presses.

88. M. Vogl. Fastening for bags.

94. E. Stevens. Ovens, hot plates, and cooking apparatus.

98. A. I. Mahon. Screw and paddle propellers, and a submarine propeller, also applicable to the raising and forcing of water.

101. J. B. Fenby. Apparatus to be attached to pianofortes, organs, and other similar keyed instruments, for printing the score of any music performed on the said instruments.

103. D. and J. Tannahill. Rivet-making machinery.

108. W. Southwood. Machinery for manufacturing nails or brads.

111. L. Lescuyer. India-rubber over-shoes or goloshes.

120. G. A. Biddell. Machines for pulping turnips and other vegetable substances.

122. J. Lawson. Apparatus for holding castings and other pieces whilst being planed and shaped.

125. T. Wilkinson. Manufacture of tubular steam boilers.

139. J. W. Child. Apparatus employed in spinning and weaving.

143. R. A. Brooman. Machinery for the manufacture of lace and other fabrics. (A communication.)

145. L. Verdure. Slubs or rovings.

152. I. Ashe. Apparatus for preventing sea-sickness.

153. J. Combe. Machinery for spreading, drawing, and carding flax.

167. J. Mosheimer. Machinery for crushing and grinding quartz.

183. J. Holt. Willowing and opening cotton.

202. N. Wood and J. Stockley. Apparatus for grinding, smoothing, and polishing plate glass.

213. C. Turner. Manufacture of felted fabrics.

227. J. B. Fell. Working railway engines and carriages on steep inclines.

246. W. E. Gedge. Apparatus for fastening by screws boots, shoes, and other articles composed of leather. (A communication.)

254. W. Conisbee. Cylindrical chromo-lithographic printing machines.

325. W. Betts. Apparatus for applying metallic capsules to bottles.

331. B. F. Bates. Cannon, and in projectiles to be used therewith. (Partly a communication.)

370. E. T. Hughes. Apparatus for drilling wood, stone, iron, or other materials. (A communication.)

522. E. B. Wilson. Manufacture of an alloy or alloys of titanium and iron.

540. A. Capello. Apparatus for glazing Morocco leather.

696. J. C. Richardson. Construction of ships.

756. G. A. Biddell. Locomotives, usually called traction engines, to be used on common roads.

875. J. Macintyre. Manufacture of knobs and other articles in china and earthenware.

893. D. J. Cooke. Compositions for sizing, stiffening, and colouring yarns and textile fabrics.

895. F. J. Risse. Haft or handle for holding tools or instruments of various sizes.

956. I. Baggs and W. Simpson. Purifying and treating coal gas, sulphuretted hydrogen, and other gases containing sulphuretted hydrogen, and in obtaining sulphur, sulphuric, and other acids in such treatment.

994. W. E. Newton. Wrenches. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 15, 1863.

3087. W. Dobson.
3093. J. Orbös.
3094. P. H. Klein.
3095. W. H. Burnett.
3096. W. P. Houghton.
3097. C. W. Harrison.
3098. C. Neild and J Hopkinson.
3103. L. Lenzberg.
3105. J. Chalmers.
3108. J. Orbös.
3109. R. A. Brooman.
3116. C. Stevens.
3118. F. Fletcher.
3120. J. W. Child.
3121. F. Seiler.
3126. C. Hadfield and W. A. Atkins.
3132. T. Walker.
3138. S. and C. Deacon.
3251. R. D. Kay.
399. J. C. Jeffcott.

Sealed May 19, 1863.

3127. J. Townsend.
3133. C. Wagner.
3137. C. A. Orth.
3139. A. Sutton.
3140. W. E. Gedge.
3141. W. E. Nethersole and C. Buckland.
3144. C. Powell.
3155. W. Tatham.
3159. A. L. Woolf.
3184. W. Clark.
3189. J. H. Johnson.
3193. W. Clark.
3207. Rev. H. Moule.
3221. P. W. Reuter.
3223. B. Oldfield.
3270. H. A. Bonneville.
3310. S. B. Whitfield.
3326. T. E. Vickers.
3383. E. Lepainteur.
3393. A. V. Newton.
24. E. Skull and E. Mealing.
253. J. Platt.
262. H. A. Bonneville.
458. N. Thompson.
517. F. A. Gatty.
521. W. Readman.
638. G. T. Bousfield.
716. W. E. Newton.
734. G. Haseltine.
770. G. Davies.
798. W. Blake.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1193. G. H. Barth.
1195. J. Higgins and T. S. Whitworth.
1220. J. Cole.
1225. J. D. Dunnicliff and S. Bates.
1226. W. Greeves.
1235. J. Lees.
1266. W. Clissold.
1270. T. Cope.
1300. G. De Laire and C. Girard.
1382. G. Hadfield.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1178. G. Carter.
1185. J., T., and G. Wilkes.
1219. J. C. Pearce.
1267. W. E. Newton.
1513. A. Shanks.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending May 16, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2721	0	4	2734	0	4	2746	0	6	2757	0	6	2768	0	4	2779	0	10
2722	0	4	2735	0	10	2747	1	10	2758	0	6	2769	0	4	2780	0	4
2723	0	4	2736	0	10	2748	0	8	2759	0	4	2770	0	8	2781	1	8
2724	0	4	2737	0	6	2749	0	8	2760	0	8	2771	0	4	2782	0	4
2725	0	4	2738	0	10	2750	1	0	2761	0	4	2772	0	10	2783	0	4
2726	0	4	2739	0	4	2751	0	10	2762	0	8	2773	0	8	2784	1	0
2727	0	6	2740	0	4	2752	0	10	2763	0	4	2774	0	4	2785	1	0
2728	0	10	2741	0	10	2753	0	6	2764	1	10	2775	1	0	2786	0	4
2729	0	10	2742	0	4	2754	0	8	2765	0	10	2776	1	8	2787	0	4
2730	0	4	2743	0	4	2755	0	6	2766	0	8	2777	0	6	2788	0	10
2732	0	4	2744	0	10	2756	0	10	2767	1	0	2778	0	8	2789	2	4
2733	0	4	2745	0	4												

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	p ct.
IRON:—									
Welsh Bars, in London	per ton	6	7	6	to	6	10	0	2½
Nail Rods	do	7	0	0		7	10	0	
Hoops	do	8	5	0		8	10	0	
Sheets, single	do	9	5	0		9	10	0	
Staffordshire Bars	do	7	5	0		7	10	0	
Bars, in Wales	do	5	10	0		5	17	6	
Rails	do	5	10	0		0	0	0	nett
Foundry Pigs, at Glasg, No 1	do	2	11	0		0	0	0	
Swedish Bars	do	11	10	0		11	15	0	2½
STEEL:—									
Swedish Keg, hammered ...	do	16	0	0		0	0	0	
Swedish Faggot	do	16	10	0		17	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts...	do	96	0	0		0	0	0	3
Hammered Bottoms	do	106	0	0		0	0	0	
Flat Bottoms, not Hamrd....	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	7¾		0	0	8¼	
Fine Foreign	per ton	94	10	0		95	0	0	
TIN:—									
English Block	per cwt.	5	19	0		0	0	0	2½
do Bar	do	6	0	0		0	0	0	
do Refined	do	6	4	0		0	0	0	
Banca	do	6	8	6		0	0	0	nett
Straits	do	6	4	0		0	0	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	8	6			0	6	
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
LEAD:—									
Pig, English	per ton	20	10	0		23	0	0	2½
,, Spanish Soft	do	20	0	0		0	0	0	
Shot, Patent	do	23	10	0		0	0	0	
Sheet	do	21	10	0		0	0	0	
White	do	26	10	0		0	0	0	
SPELTER:—									
On the spot	do	18	0	0		0	0	0	nett
ZINC:—									
English Sheet	do	23	10	0		0	0	0	2½
QUICKSILVER	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	42	0	0		0	0	0	2½

TIMBER, duty 1s. per load, drawback 1s.

Teak............... load	£12	0	£13	0
Quebec, red pine	3	10	4	10
,, yellow pine .	3	10	4	10
St. John, N.B., yellow	0	0	0	0
Quebec oak, white ...	5	10	6	10
,, birch	3	10	4	10
,, elm	3	10	5	0
Dantzic oak	3	10	6	10
,, fir	2	10	3	10
Memel fir	3	5	3	10
Riga......	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzic, fm	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	18	10
St. John, white spruce	14	0	15	10
Yellow pine, per reduced C.				
Canada, 1st qual. ...	17	0	18	0
,, 2nd do......	11	0	12	0

Archangel, yellow...	£13	0	£13	10
St. Petersburgh, yel.	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white.	9	0	9	10
Gefle, yellow	10	10	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12ft by 3 oy 9 in.				
Christiania, yellow	21	0	2	
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14		
PUMICE STONE pr ton	5	10		
OILS, &c.				
Seal, pale ...per tun	48	0	48	10
Sperm body	83	10	85	0
Cod.......................	49	0	50	0
Whale, Sth Sea, pale	45	0	45	10
Olive, Gallipoli	58	0	59	0
Cocoanut, Cochin...	49	0	51	0
Palm, fine	37	0	37	10
Linseed.................	45	10	0	0
Rapeseed, Eng. pale	51	10	0	0
Cottonseed	38	10	[illegible]	0

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, MAY 29, 1863.

HIGH PRESSURE BOILERS.

COULD the shade of the illustrious Watt make a little tour through our manufacturing districts, the timid ghost would need but a glance at the pressure gauges on the boilers now in use, to find a sufficient inducement to return to the regions from whence it came. Forty years have done much to extend the use of far higher pressure than Watt ever contemplated. Many idle prejudices—many erroneous notions have died a natural death during the last half-century. The employers of steam power, the class really far more interested than engineers, in improvements, day by day become more alive to the fact, that without expansion there can be little economy; and the use of a pressure which the past generation of engineers would have considered dangerous in the extreme, follows as a matter of necessity.

All civilized nations are more or less employers of steam power; and it is strange enough, that in no country save our own, has any extended prejudice been entertained against high pressures. Belgium, France, and America early perceived the advantages to be derived from their use; the latter country, in particular, has received an unenviable notoriety for the reckless disregard of human life displayed in the working, far more than the construction, of some of her river steam-boats; but, that these accidents are not due to the use of high pressure steam alone, is proved by the fact that the greatest number of accidents, taking the United States as a whole, have been occasioned by boilers working steam of a pressure under 50 lb. to the square inch.

England and America have each been the exponent of a separate system, each capable of giving good results, while the best only can be expected from their union. Each country has followed the teaching of its own great apostle of steam power. England received the steam-engine low pressure from James Watt, and low pressure for many years she has kept it; America got the steam-engine high pressure from Oliver Evans, and high pressure her people have retained it; by grafting Watt's condenser, and the principle of expansion, on Evans' high pressure, we can alone secure such results as 1,980,000 lb. raised a foot high in an hour, by the consumption of little over one pound of coal—a result so astonishing, that nothing but accurate and well-attested experiments, could convince us that practice might be made to wait so closely on theory.

Although high pressure steam is just as safe as low pressure, when raised in properly constructed boilers, yet in order to secure all the elements of safety, it is found necessary to resort to forms and principles of construction very different from those suitable to low pressure generators. In consequence, their variety is almost endless; good, bad, and indifferent, we could count some hundreds of schemes in the Patent Office for the construction of boilers to raise steam from 100 lb. to 500 lb. per square inch. The fact is that many practical difficulties are involved, which have proved strong stimuli to the combative faculties which induce inventors to go in search of such obstacles, merely for the pleasure of overcoming them. Our present purpose is to glance at some of the most important desiderata in the construction of high-pressure generators, some of the more obvious difficulties to be encountered, and a few of the plans hitherto adopted with most success.

Boiler explosions have occurred ever since the day water was first boiled in a closed vessel; and boilers will explode, for anything we can see to the contrary, to the end of time. We feel no hesitation in endorsing the words of Dr. Alban, and repeating, that our great guiding principle should be "so to construct the boiler that its explosion may not be dangerous," a result easily attained by generating the steam within small tubes, or flat spaces strongly stayed, so that the boiler really consists of an assemblage of small generators, more or less detached and distinct one from the other. By this means, not only is great strength secured, but the quantity of steam and water to be suddenly dispersed is so much reduced that little danger can result from an explosion. The small tubes are invariably the weakest parts of such boilers, and being thin, they open quietly, without flying in pieces; hence none of the destructive results due to the propulsion of heavy masses of metal to great distances can ensue. Boilers of this construction are usually termed "tubulous," to distinguish them from "tubular boilers," in which, instead of the small tubes containing steam and water, they are made use of as flues to convey the products of combustion to the chimney.

Very excessive pressures have been raised years ago in these tubulous boilers—pressures, indeed, before which anything we now see in daily use, sinks into insignificance. Jacob Perkins has employed a pressure of 500 lb. on the square inch for propelling bullets; Dr. Alban, of Plau, in Mecklenburgh, worked an engine in London, many years ago, at a pressure of 1,000 lb. on the square inch with the greatest success. Perhaps the nearest approach we have had to these pressures of late years, was in an engine exhibited at the Agricultural Show at Salisbury in 1857, by Mr. Collinson Hall. This engine was worked at a pressure of 300 lb. to the square inch, and gave an indicated horse-power for each 1·25 lb. of coal consumed per hour. The boiler was, we believe, of the upright tubular class, some 2 ft. 6 in. in diameter, and 6 or 7 ft. high, with a circular fire-box in the lower part, and 40 or 50 vertical flue tubes passing through the water and steam (which last they superheated considerably) to the uptake. The explosion of such a boiler as this, would of course be attended with disastrous results if the outside shell gave way. And although such boilers are very compact, and capable of standing very high pressures with safety, 'yet they are in general so subject to priming, and difficult to clean, deposit settling in a hard mass on the crown of the fire-box, from which it cannot be removed, that their use is seldom or never to be recommended. Mr. Hall is not, of course, the inventor; it would be difficult indeed to say who is.

Mr. Martin Benson invented and patented a very good form of high-pressure boiler three or four years ago. As it was brought a good deal before the notice of the public at the time, our readers may perhaps be sufficiently acquainted with it to prevent the necessity of a detailed description, for which we have not space. It consists of a great number of small tubes traversing a vertical fire space; the ends of all the tubes are so connected by a very simple and ingenious arrangement, quite protected from the action of the fire by the side walls, as we may call them, of the fire space, that they become one. A vertical receiver of considerable height and moderate diameter is placed at the side of the generator. A small pump, fixed at the bottom of this, and worked by the engine, forces the water in a continuous current through the tube. Entering at the bottom and passing backwards and forwards through all its windings, it is discharged at the top, mingled with steam, into the upper part of the receiver, or steam chest, where the water, separating from the steam, falls to the bottom, while the steam flows through a suitable pipe to the engine. This boiler is said to have given very good results, but has not hitherto met with much favour, owing to a prejudice against the use of the circulating pump. Whether an injector would better answer the purpose of maintaining a current remains to be proved.

Mr. Benson's boiler may perhaps be regarded as the best of a class of generators, in which the distinguishing principle is the forcing of water through a continuous coil of tube of small diameter, exposed in whole, or in part, to the action of a furnace. From various causes these boilers have never met with extended adoption.

Dr. Alban's may be regarded as the type of a far superior class of generator, in which a large flat vessel, with the sides very heavily stayed together, usually called the "heart," is made the means of communication between a very large number of tubes, about 4 in. in diameter, and 6 or 8 ft. long; one end of each of these tubes is firmly fixed in the front plate of the heart, which stands just over the fire door. The tubes traverse horizontally a fire space some 6 or 8 ft. high, built of brick on three sides, the heart forming the fourth. All the tubes are set on a slight incline from the heart downwards, so that the steam may, by its own levity, rise towards and enter the heart, while the water, by its gravity, flows into the tubes to replace that evaporated. The ends of the tubes furthest away from the heart are stopped by moveable covers, which can be removed to clean the tubes, as at this end they pass through the brick wall of the fire space, in order that they may expand freely. A simple arrangement of plates in the heart conveys the steam, as soon as it leaves the tubes, to one side, where rising, it passes through a suitable tube into a separator about 12 in. in diameter, and some feet long, placed horizontally on top of the generator, but not exposed to the action of the fire; the water which rises with the steam flows back from this separator through a second pipe, which descends at the other side of the heart, and rising from it re-enters the tubes, and is in part converted into steam as before. This boiler, though very expensive, is an extremely durable and economical generator of steam, from 100 lb. to 300 lb. on the square inch; and the tubes being the weakest part of it, an explosion never leads to any dangerous results, from the reasons already pointed out. It enjoys a very good reputation on the Continent, although we believe never yet used in Great Britain.

A class of boilers much the same in principle but very different in construction, has been gradually creeping into favour of late years. The distinguishing characteristics of this generator are an outside shell, square, oblong, or circular, in horizontal section, according to circumstances, which has a second shell, or fire-box, about 6 in. smaller, placed within it, much as the inside fire-box is fitted in a locomotive. In the bottom of the inside box, which is heavily stayed to the outside shell, is placed the fire-grate, while the upper part is traversed by a number of small tubes feruled into the inside shell at each end; the flame and heated air pass upwards between these tubes to the chimney, which is usually placed directly above.

This kind of boiler, although cheap, possesses many disadvantages; it is very heavy; it is impossible to clean the tubes without taking out the whole inside box; it is very difficult to keep the tubes tight at the ends; and as it is frequently constructed without any regard to correct principles, it has in addition been accused of excessive priming, which is likely enough when we consider that the tubes are not only very small, but put in on a dead level, so that a constant contention goes on between the water and the steam—one struggling to get out, the other to get in. The tubes should always be put in on an incline of at least 1 in. to the foot, when the steam will escape quietly from the highest end, while the water will enter quietly at the lowest; a constant circulation is thus kept up, which not only permits the supply of dry steam to the engine, but conduces materially to the durability of the boiler.

Whether a boiler can be produced which will permit the use of sea water under high pressures, is a question we need scarcely enter on; the success which has attended the introduction of surface condensation rendering such a boiler needless. Still, certain mechanical difficulties stand in the way of the general adoption of tubulous boilers on board ship; one of the most important is the difficulty of obtaining room enough for the introduction of a new tube in case of accident. This difficulty is not experienced when introducing an ordinary flue tube, because such tubes invariably present their ends to the firing space, which is usually 8 ft. or 10 ft. wide; but, owing to difficulties entailed by the position of the uptake, the tubes, when horizontal, must almost unavoidably run parallel with the firing space when the stoke-hole bulk-heads preclude the withdrawal or replacement of the tubes; another, and still more serious objection, is the great height of boiler necessary when tubes 4 in. in diameter are employed. Unfortunately, when of smaller size, they are never durable, being very liable to boil dry for a few seconds, when of course they become overheated, and again cooled down by the rush of the re-entrant water; they are thus soon burned out; large tubes always "steam quietly," and are found durable enough. In consequence of these difficulties, many boilers have been introduced from time to time, in which the steam and water are contained in a large number of flat-sided vertical spaces, well stayed, and arranged like books on a shelf, spaces being provided between them for the circulation of the flame and heated air. Such boilers are all more or less complicated, heavy, and expensive; and although the principle is good, it still requires much improvement before it can be considered worthy of general adoption. Marine boilers with vertical water tubes, have met with much favour in America, and seem to deserve the good character they bear. Although horizontal surfaces are invariably the most economical, yet the practical exigencies of marine boiler construction, often dictate a recourse to vertical surfaces as most convenient.

A rather singular arrangement of tubes is sometimes adopted in American steam fire-engines. A large number of moderately-sized tubes descend from a strongly-stayed water and steam space right down to the grate, which they surround; the lower end of these tubes is stopped. Within each of them a second tube of much smaller diameter descends nearly to the bottom. The water continually descends though this tube, and ascends mingled with steam in the space between the two; a constant current being thus effectually maintained. The products of combustion escape through flue tubes fitted in the water space above.

It is a mistake to imagine that a small quantity of water is absolutely necessary to the rapid generation of steam. We have seen steam raised in a small road locomotive, with an ordinary tubular boiler, from 80 lb. to 100 lb. in one minute and a half, or at the rate of 13 lb. in a minute.

Before concluding this article, we would impress on our readers that nothing is more dangerous than the raising of steam to excessive pressures in boilers of a couple of feet in diameter. The explosion of such boilers, especially if the metal is thick, is certain to be attended with the worst results; and from their small size, it is almost impossible that their workmanship can be as good as when a larger diameter is adopted—say 3 or 4 ft. Boilers of these sizes can be, and are daily, worked with safety under pressures of 150 lb. to the inch; and, all things considered, if no increase on that pressure is desired, we know of nothing safer or more economical as a generator than a well-made, properly-proportioned locomotive boiler.

NOTES OF THE BIRMINGHAM MANUFACTORIES.

UNDER the above head we intend presenting our readers with short notices of some of the most celebrated branches of trade which have rendered Birmingham famous. As our limited space prevents our entering into minute details, we purpose, without neglecting anything which is necessary to enable our readers to thoroughly understand the subject on which we write, to point out only a few of the more remarkable features of trade and manufacturing operations, which are either singular in themselves, not generally known, or tend powerfully to cheapen the products of industry. The subject we have chosen for this week is the manufacture of electro-plated goods, as carried on at Messrs. Elkington's establishment.

In the arts or sciences we have few instances of the successful development of new inventions or discoveries in short spaces of time; not only is the growth of ideas gradual, but experiments undertaken by private individuals, to confirm or test the actual value of new inventions, frequently extend not only over months but even years, and then require further development at the hands of the manufacturer. In chemical science especially, we find that the most refined laboratory investigations seldom prove of more value to the manufacturer, than just to demonstrate the practicability of any improvement in his art; so many alterations are necessary to suit laboratory practice to all the exigencies of trade on a large scale before a thing can be made to pay, that much time must almost invariably elapse before we see new processes brought successfully under public notice. We meet with a few exceptions to this rule, but none more remarkable than that afforded by the history of electro-plating, which has risen to an importance which places it amongst the most considerable of the Birmingham trades in the short space of twenty years.

Many of our readers may, perhaps, remember that Mr. Jordan, in May, 1839, made his experiments in electro-metallurgy, known to the public through the medium of this MAGAZINE. Professor Jacobi's investigations, too, were made public in England about the same time; but it was not for some years afterwards that the subject was taken up by Messrs. Elkington and Mason, and carried by them, under many difficulties, to its present perfection.

Messrs. Elkington carry on business in a large quadrangular pile of buildings in the northern quarter of the town; and it may not prove uninteresting to mention that such is the value of space, that a considerable portion of the factory is built on arches over the old Birmingham canal.

The first points worthy of notice are the magnificent show-rooms, beautiful in themselves, even without the countless treasures of art displayed within them. Were we writing for the *Art Journal* we might stop to dwell on the beauties which attract the eye at every turn; but as our mission is the practical rather than the æsthetical, we must hasten on with a passing mention of two or three objects of interest—one being a beautiful service in the Pompeian style, remarkable not alone for its beauty of design or workmanship, but for its very peculiar red enamel, only found hitherto on old services, and the art of making which, long lost, has only recently been recovered by Messrs. Elkington. Any enameller can produce a glossy red of any shade, but this is dull or without glaze of any kind, and in consequence produces a very singular effect. The Chinese believe that they alone possess the art. As it is scarcely a suitable subject for a patent, we may observe that the means of producing it remain a secret. In this room also we saw some beautiful photographs and drawings of the silver table presented to the Princess of Wales by the inhabitants of Birmingham. This table was commenced four years ago, not to order, but merely as a work of high art, originating in the enterprise of the firm, its actual cost being no less than £2,000. We also noticed a magnificent centre-piece in silver gilt, presented to Charles Cammell, Esq., of Sheffield, steel manufacturer, by his workmen.

Passing from these rooms we enter another, containing many beautiful groups, formed by the "galvano-plastique" process—one so singular as to merit a good deal of attention. In executing any work, large or small, on this principle, the first thing is to make a suitable design in clay or wax, from which a model is cast in plaster of Paris, and from this again one in a fine composite metal; this last is carefully chased over by artists, who render the casting a complete work of art. On its completion, it is sent to another part of the building, where, after suitable preparation, it has an exceedingly thin coating of copper deposited on, but, owing to the precautions taken, not adhering to it; this thin film of copper, which is an exact copy, to the minutest detail, of the metal model, is then backed up with wax, and being placed in the depositing baths, receives a coating of fine copper, as before, perfectly detached from the mould. This coating may be of any thickness, according to the time the article remains in the bath. It will be understood that very large articles, such as groups, figures, &c., are modelled piece by piece, but the different parts of the model are all put together to receive the final deposit which, when the mould is cut off it, as we cut the skin from an orange, comes out the perfect statue or group, without requiring tooling or operation of any kind, save a simple washing to bring out the fine colour of the copper. It may be worth while to remark that as no shrinkage of any kind takes place, the design, as given originally in the brass model, is found in all its exactness, without the slightest distortion in the finished work. Artists will not be slow to appreciate such an advantage.

On leaving the show-rooms, we enter the studio, where the designs and plaster casts are prepared, and, crossing the canal by a foot-bridge, enter the yard where the large copper depositing houses are situated. At the time of our visit the colossal figures for the Memorial of the Exhibition of 1851, in course of erection in the Royal Horticultural Society's gardens, were being made, the figure of Africa having just been removed from the bath. As our readers are doubtless aware, the design includes very beautiful figures of Europe, Asia, Africa, and America, at the corners, surmounted by a figure, in the original design of Her Majesty, but since altered to that of the late Prince Consort. Two or three of the figures have already been sent to their destination. The extreme accuracy with which the minutest detail of the original design is given in the finished statue, is sufficiently remarkable. As may be supposed, the depositing vats are of great size, one of the six or seven in the room being no less than 15 ft. long, by 10 ft. deep, by 8 ft. wide.

Leaving the subject of statuary, we enter on the general production of electro-plated goods. Our readers are too well aware, doubtless, of the nature of both the old and new processes of plating to require a detailed description of the principles involved, but we think one or two facts are not generally known. Thus, such a thing as "solid silver edges," as they are called, do not exist, in the accurate sense of the term—the edges so called consisting of a very thin plate of silver struck between dies into the form required, two such plates being soldered together with soft solder, the space between them is filled up with some soft white fusible metal, and the whole fastened in its place with soft solder on the dish or other article. We may remark that this course is never employed at Messrs. Elkington's—no necessity, indeed, existing for it, as all the articles are plated on a peculiar composition of copper and nickel, which itself possesses the lustre of silver and its peculiar metallic ring to such an extent that it is rather difficult to determine which is silver and which the baser metal. This compound metal is cast into figures, and rolled into plates and rods by operations so similar to those employed in the manufacture of copper as to need no further comment—dishes, coffee-pots, &c., being all formed from sheets of different thicknesses, and brought into form by the use of the hammer, and sometimes dies put into action by powerful stamping presses. We find one of these in a lower room, which will take dies 30 in. in diameter; some idea may be formed of its size when we state that the solid cast-iron anvil block weighs 13 tons. All the dies are made on the premises, the present stock having cost no less than £75,000, a sum which those acquainted with the tedious and expensive process of die-sinking will not think extravagant. Very many articles are, however, formed solely by the use of the hammer.

There are few processes in the arts more singular than the formation of a tea-pot almost globular in form from a single flat sheet of metal; when we reflect that it is brought to form altogether by the use of the hammer, and that the metal is not only hard, but exceedingly brittle, our wonder does not diminish. A continuous course of annealing goes on from first to last, the workman determining with unfailing accuracy how far he can go without reheating the article. The annealing is performed in a very ingenious furnace constructed on the reverberatory principle; in the bed of the furnace is fixed a circular disc of fire clay, say 4 ft. in diameter, on which the articles to be annealed are placed, when the disc, which is fixed horizontally on a vertical shaft, is caused to revolve slowly, thus exposing them to an equal degree of heat. When they have been maintained at a bright red for a short time they are removed, and suffered to cool slowly, and then returned to the proper shops, where they advance another step towards that ultimate beauty of shape which renders modern plate so celebrated.

Should the tea-pot, vase, &c., belong to the more expensive class, the next operation is to ornament its hitherto plain surface with groups, flowers, &c., in "repoussé" work, in which the devices are raised up on the front of the dish, &c., by hammering corresponding depressions in the back, as in the silver table we have before alluded to; but the process, simple as it may seem, is, nevertheless, one of the most singular in the whole range of the arts. Most persons imagine that it is produced by a small punch, struck by a hammer. When we state that claret-jugs, coffee-pots, &c., are never repousséd until they are otherwise completed as to form, save the spouts and handles, it will be seen that it would be utterly impossible to introduce a chisel and hammer, unless, indeed, the artificer were sufficiently small to creep inside and use diminutive tools there; and really, when we consider the fairy-like character of many of the designs, and the minute accuracy they display, it is no great stretch of imagination to conceive them the work of one of Queen Mab's own artificers; but, as imagination will never repoussé a tea-pot, let us describe the actual process.

The article having been carefully cleaned, smoothed, and brought to a certain degree of polish, first has the design carefully pencilled on its surface. A row of powerful vices stand at one side of the repoussé shop; in the jaws of each vice is fixed a bar of steel about ⅜ths of an inch square; this bar is so bent as to stand horizontally, at right-angles to the vice bench; it is some 15 or 18 in. long, and the end having been drawn to a blunt circular point, is turned up at right-angles to the bar, so as to stand about half-an-inch above it. The point is made very hard and polished; its diameter varies for different work, an average would be about a quarter of an inch. The steel bar is wrapped with soft string from near the point to about 6 in. from the vice. The whole thing is as rough as can be conceived.

The artist, for so we must call him, taking the vase, &c., to be repousséd in his left hand, passes the rod of steel through the mouth, and resting it solely upon the turned-up point, strikes, not the vase, but the steel rod, with a moderately heavy hammer—strikes it downwards be it understood, and of course away from the article. The spring or jar of the rod recoiling by its own elasticity from the force of the blow, in combination with the inertia of the vase, which is held loosely, produces an indentation more or less deep on the inside, accompanied by a proportionate elevation on the outside. A repetition of the process, with a suitable movement of the vase by the skilful hand of the workman, produces all the beautiful details of the most elaborate design. The growth of the pattern under the hands of the artist seems more like a work of legerdemain than a simple result of skill—it is beautiful to see, difficult to describe. We can but hope that our readers understand us.

It is not a little strange that the origin of this kind of work is unknown. The Indian of the Himalaya Mountains, the Persian fire-worshipper, the rudest Italian artificer, use precisely the same means from time immemorial to produce the same result; from one end of the earth to the other, the art is understood and carried on, century after century, without alteration or improvement, save in the design produced—indeed, all attempts at improvement have proved utter failures; no machine can give the peculiar touch of the artist; we might as well endeavour to paint a Rubens or a Titian by machinery. There is, indeed, a false kind of repoussé work produced by striking plates of metal between dies; but, although beautiful enough, it bears little resemblance to the true work.

It must not be imagined, however, that the work is complete when it leaves the hand of the repousseer. From him it passes to other artists, who, filling the vase, &c., with pitch to impart a certain solidity, give it certain small finishing touches by the use of the hammer and minute punches and chisels, by which small depressions are beaten in the outside as they had just before been beaten within; nothing then remains but to attach the spouts, handles, &c., and prepare it for plating by a thorough cleansing.

Few articles of plate being all in one piece, the operation of fastening them together next claims our attention; but we may premise that figures, trees, and filagree work, on a small scale, are all cast from German silver by ordinary processes, and being chased up, are afterwards fixed in their places by hard solder. The foundry arrangements at Messrs. Elkington's are on a very extensive scale, as the production of cast figures, &c., is very great.

We have already said that no soft solder is used for any purpose at Messrs. Elkington's; and owing to the great heat, nearly 1,500 deg. Fahr., required to fuse the hard solder employed, some very peculiar arrangements are adopted. The soldering shop is, as one consequence, about the noisiest shop in the establishment. Opposite each man is a kind of circular tray, capable of revolving on an upright shaft at the will of the workman; these trays are filled with hard charcoal in small pieces, on which the article to be soldered is placed. Along the wall run two pipes or mains—the smaller of those conveys gas, the larger air under a high pressure. Flexible tubes proceed from each and unite into one a few inches behind a nozzle, which has a circular orifice nearly half an inch in diameter; cocks are fitted to each pipe. The effect of this arrangement is that the flame of the gas violently impelled by the current of air with which it mixes just before it reaches the mouth-pieces, issues in a long bluish jet, giving little light but an intense heat—indeed, articles of a considerable size are raised to a bright red heat in a very short space of time after the jet is turned down on them. Our readers will understand that each workman has one of these blow-pipes at his command. The intense heat is due to the intimate mixture of the oxygen of the air with the hydrogen of the coal gas, the general principle involved being, in fact, precisely that of the oxyhydrogen blow-pipe. Some peculiar arrangements are necessary, as may be supposed, to prevent the high pressure air forcing its way into the gas main; by simple means, however, the jet of air rather tends to draw the gas from the main, much on the principle of the Giffard injector. The noise produced by so many blasts, is, however, very considerable when a number of men are at work at the same time. The mere operation of soldering is too well known to present any feature of interest.

On the same floor we find a very elegant application of steam power as a substitute for hand labour. The old process of "planishing," or hammering a plate all over to condense its particles, was both tedious and laborious; here, however, we find a beautiful little machine on the principle of the atmospheric tilt hammer. A bar of steel, about 3½ in. in diameter, turned truly circular, has its lower end finished to a slightly spherical form, while the upper end passes, through a stuffing-box, into a small cylinder, as the plunger does into a force-pump. About the centre of the box, which may be 3 ft. long, a slot is made, within which a cam, fixed on a horizontal shaft, works, causing the bar to make about 150 very short vertical strokes per minute; the speed admits of easy regulation. A suitable anvil is placed underneath, at which the workman sits conveniently, and moving the article to be planished under the hammer, has his work performed for him in a wondrously short space of time, and with an accuracy unattainable by hand. This is almost the only process in electro-plate work where machinery has superseded hand labour, all attempts at its introduction in other operations having proved failures; even the stamping presses, of which there are seven or eight, being all worked by hand, except the large one we have already referred to, and one other of smaller dimensions.

We next enter the depositing shop, not that we have already referred to, but one of somewhat smaller size. Long troughs containing the solution of silver traverse the room. It is foreign to our purpose to enter into the chemical details of electro-plating; but a word is necessary on the means of obtaining the electric current; besides galvanic batteries with large plates, and generally only single couples, which give a great quantity of electricity, without much tension, we find in this room a very powerful electro-magnetic machine, worked by a small steam engine, of very elegant design, fixed at a little distance. The magnetic machine very much resembles that which was exhibited last year in the Machinery-in-Motion Court, at South Kensington. Its current which, though small in quantity, is of enormous tension, is employed for plating spoons, forks, and all articles subject to much wear, as the deposit, when such a current is employed, is of greater hardness than it is possible to procure by any other means. Dish covers, and all articles not subject to so much wear, are plated by the action of the galvanic battery, which, with but a slight reduction of hardness, effects the operation in a much shorter time.

In the two long tanks alone in this room not less than £6,000 worth of silver solution is contained, 10 oz. of solid silver being dissolved in each gallon of the solution. In this room also are two or three small tanks for depositing gold; although containing but a few gallons comparatively, they nevertheless manage to hold about £2,000 worth of gold in solution, which being hot gilds with surprising rapidity. We saw the inside of an egg-cup sensibly gilded in half a minute; two to five minutes generally give a rich coat of gold; five or six hours are required to plate silver articles.

On leaving the baths the articles are brightened by revolving brass wire brushes and ale wort, and are then sent to be planished; in this operation, every article which presents a broad flat surface is hammered all over to condense and harden the silver coating. The remaining processes of burnishing and cleaning present no features of much importance; and as we have already overstepped the limits at our disposal, we must conclude by expressing our thanks for the courtesy shown us by the representatives of a firm, whose importance, even to so large a town as Birmingham, may be imagined when we state that it gives employment to about 1,100 hands, and has branch houses in the City and West End of London; also in Liverpool and Dublin.

Mr. Ansdell's picture, "The Hunted Slave," has been presented by that gentleman to the town of Liverpool.

THE SOILS OF ENGLAND.

On Friday, the 8th inst., Dr. Augustus Voelcker, F.C.S., Consulting Chemist of the Royal Agricultural Society of England, delivered a lecture before the Royal Institution, "On some Chemical and Physical Properties of Soils, and the Productive Powers of the Soils of England."

In all fertile soils, said the lecturer, we find variable quantities of organic matter—ready-formed ammonia, nitric acid, potash, soda, lime, magnesia, oxides of iron, chlorine, phosphoric, sulphuric, and silicic acids; in short, all the mineral matters which are found in the ashes of plants. These minerals, or ash-constituents, it need scarcely be observed, are not merely accidental but essential materials, without a proper supply of which no plant can grow luxuriantly and come to full maturity. In one sense, all are equally important; for the absence or deficiency in the soil of one, be it lime or potash, phosphoric or silicic acid, is detrimental to the luxuriant development of the vegetable organism. No one who has given the slightest consideration to this subject will hesitate to give assent to this mineral theory.

It is natural to connect the productiveness of soils with the proportion of ash-constituents of plants which they contain; but although in some cases a soil may be unproductive on account of the absence or deficiency of lime or potash or phosphoric or any other mineral matter which enters into the composition of plants, in the majority of cases the chemical analysis of different soils affords little or no indication of their relative productive powers.

The combinations in which the mineral constituents of plants exist in the soil, their unequal or uniform distribution in the surface, the composition and physical condition of the subsoil, the relative depth of both, the porosity of the land, and especially the power of absorbing and retaining, as well as modifying in a variety of ways the crude manuring agents which are applied to the land, unquestionably are intimately connected with the great variations which we notice in the agricultural capabilities of different soils.

Before the publication of Liebig's celebrated "Chemistry in its Application to Agriculture," a work which has given the death-blow to the humus theory, the fertility or barrenness of a soil was generally considered to depend entirely upon its physical properties and the presence or deficiency of humus. Soon after the publication of Liebig's writings, scientific men fell into the opposite extreme, and expected the bare chemical analysis of a soil and the ash-analyses of plants would enable them to discover at once the means of restoring the fertility of land, or to improve it by certain purely mineral manuring mixtures, and to grow on it, irrespective of its natural adaptation to the growth of particular crops, any kind and almost every amount of agricultural produce.

These unphilosophical views have rendered agricultural chemistry less popular than formerly, but also more scientific and more directly useful to the enlightened agriculturist.

A new direction to chemico-agricultural inquiries was given about ten years ago by Professor Way's highly important researches on the absorptive powers of soils for manure. Professor Way's investigations originated in an observation of Mr. Thompson, of Kirby Hall, York, who found that soils have the faculty of separating ammonia from its solution.

On passing solutions of ammonia through different soils, Way found that all possess the power of retaining ammonia, some more, some less. He also observed that potash, lime, magnesia, and phosphoric acid are absorbed by all soils to a considerable extent.

Still more important are his experiments, which prove that cultivated soils not only absorb free alkalies and acids, but have likewise the power of separating ammonia, potash, and other bases from their saline combinations.

Professor Way principally operated with simple salts: it may therefore be urged, that it by no means follows, as a necessary consequence, that because a soil absorbs ammonia when a solution of sulphate of ammonia is passed through it, the same absorption will take place when an ammoniacal salt mixed with some dozen other substances is filtered through it.

I therefore operated with complex liquids, and already, in 1857, published several filtration experiments in the Journal of the Royal Agricultural Society.

These and many subsequent experiments have shown that all soils not only possess the power of absorbing and retaining potash, ammonia, phosphoric and silicic acid, and other mineral matters, but also of modifying in the most varied way the composition of complex saline solutions which are passed through them.

The following table shows the results obtained in filtering the same kind of liquid manure through two very different soils:—

Composition of Liquid Manure before and after filtration through two soils from the neighbourhood of Cirencester.

An Imperial Gallon contains:—	No. 1. Calcareous Clay Soil.			No. 2. Ferrugnous Sterile Sandy Soil.	
	Before Contact with Soil.	After Contact with Soil.	Loss or Gain.	After Contact with Soil.	Loss or Gain.
Water and volatile ammonia compounds	69,888·14	69,886·60	—1·54	—69,894·25	+ 6.11
Containing:—					
Ammonia, as carbonate and humate of ammonia	(35·58)	(20·81)	—14·77	—(33·15)	— 2·43
Organic matters	20·59	34·77	+ 14·18	—(25·06)	+ 4·47
Containing nitrogen	(1·49)	(1.84)	,, ·35	—(1·70)	— ·09
Equal to ammonia	(1·81)	(2·23)	,, ·42	—(1·70)	— .11
Inorganic matters	(91·27)	(78·63)	—12·64	—(80·69)	— 10·58
Consisting of:—					
Soluble silica	2·34	·70	— 1·64	— 5·10	+ 2·73
Oxide of Iron	none.	2·55	+ 2·36	— 2·07	,, 2·07
Lime	11·48	22·42	,, 10·94	— 8·03	— 3·45
Magnesia	2·87	1·17	— 1·70	— ·74	— 2·13
Potash	16.92	3.40	—13·52	—12·01	— 4·91
Chloride of potassium	2·74	none.	— 2·74	none.	— 2·74
Chloride of sodium	40·35	33·31	— 7·04	—39·25	— 1·10
Phosphoric acid	4·83	·60	— 4·23	— 1·92	— 2·91
Sulphuric acid	3·94	2·88	— 1·06	— 3·67	— ·27
Carbonic acid, and loss	5·80	11·80	+ 5·80	— 7·90	+ 2·10
	70,000·00	70,000·00		70,000·00	

The preceeding analytical results, amongst other particulars, show:—

1. That the calcareous clay soil absorbed about six times as much ammonia from the liquid manure as the sterile sandy soil.
2. That the liquid manure in contact with the calcareous clay soil becomes much richer in lime; whilst during its passage through the sandy soil, it becomes purer in lime.
3. That the calcareous soil absorbed much more potash than the sandy soil.
4. That the chloride of sodium, in conformity with the results of other observers, was not absorbed to any extent by either soil.
5. That both soils removed from the liquid most of the phosphoric acid.
6. That the liquid in passing through the calcareous soil becomes poorer; and, on the other hand, in passing through the sandy soil, becomes richer in soluble silica.

(To be continued.)

PATENT ICE-MAKING MACHINE.

The *Birmingham Post* gives an account of a very ingenious machine for the manufacture of ice, patented by Messrs. Siebe Brothers, of Mason-street, Lambeth, London, and manufactured by

Mr. W. H. Phillips, of the Atlas Foundry, Oozells-street, Birmingham. The machine has been made for a firm in Banbury, who have now in use one of Messrs. Siebe's machines, which is capable of producing four tons of ice per day. This machine, which is the first of the kind made in Birmingham, is capable of producing ten tons per day, and is driven by an engine of twenty-horse power. The machine has been completed only a few days, and as it was necessary to try it before exportation, it has been used, and the ice manufactured has been bought by Mr. Copner, of New-street, and others. The machine consists of an engine, a large tank, and four longitudinal troughs ot considerable dimensions, and placed side by side. In these troughs the spring water to be converted into ice is placed, in metal vessels about 2 in. wide, and some 2 ft. deep. Brine, containing as much salt as can be held in solution, is forced through the troughs, and runs round the vessels containing the spring water, and when it has run through the whole series it is pumped back into a large tank, and after being again reduced to an intense degree of cold is once more forced through the troughs, and this process is repeated until the whole of the water is converted into ice, which is turned out in slabs of even size and thickness. The degree of cold produced is so intense that the ice begins to form in about twelve minutes from the commencment of the operation. The ice made by the machine is beautifully clear, and not the least of the many advantages of the process is that no chemicals whatever are used. The manufacture of ice in tropical climates is a most important operation, and to this end Messrs. Siebe's machines have been extensively applied, one of them being now at work in Peru, almost under the Equator.

INSTITUTION OF CIVIL ENGINEERS.

May 19, 1863.

John Hawkshaw, Esq., President, in the chair.

The Paper read, was "On the Manufacture of Duplicate Machines and Engines," by Mr. John Fernie, Assoc.Inst.C.E.

After referring to the block-making machinery, designed by the elder Brunel for Portsmouth Dockyard, and to the Small Arms' Factory at Enfield, as examples tending to show that the system of duplicates both cheapened and improved the manufacture of all articles to which it could be applied, the Author remarked that, until lately, little or nothing had been done in its application to the manufacturing of machines or engines on a large scale. It was true the principle had been acknowledged, and various writers had urged the desirableness of its introduction into the railway system; but with such large component parts, special machines were out of the question, and the only other possible mode was working to a correct standard.

Mr. Whitworth (M.Inst.C.E.) had advocated, in several Papers read before different scientific societies, the adoption of a system of measurement for mechanical engineering work, in which the inch was to be the basis, subdivided into a thousand parts for the finer dimensions. In 1851, he exhibited a machine for obtaining fine accurate measurements by touch, and he showed, by models, that the thousandth of an inch was not only an appreciable quantity, but in many cases its difference was what constituted a bad fit.

The Author, having been satisfied that the mode of taking dimensions in the workshop was behind the times, had, with the sanction of Mr. Kirtley, the locomotive superintendent, established during the last five years, in the workshops of the Midland Railway at Derby, a system which had proved most beneficial, not only in reducing the cost of the work, but in greatly reducing it; and at the same time perfecting the only plan by which all the parts of engines could become duplicates of one another. The system of end measurement and a gravity piece, as invented by Mr. Whitworth, was adopted, and a machine was constructed capable of taking in 100 inches. This machine consisted of a strong bed plate, having on the upper surface a V-groove, planed throughout its whole length. At one end there was a headstock, through which a square spindle, fitting the groove, was propelled by a hand wheel, which formed the nut of a screw having ten threads to an inch. This nut was in two parts, and could be tightened up by screws, so as to prevent lateral play; and a collar washer, also adjustable, prevented any play in the headstock. The other end of the bed had also a headstock and screw movement, so as to adjust the length of the pieces in the groove, and bring the readings of the index to O. The difference between this machine and Mr. Whitworth's was in the way the subdivisions of the inch were obtained. In the Whitworth machine a screw with exactly ten threads to an inch was first made; whereas, in this machine, as a screw could not be found with exactly ten threads, it was necessary to run a thread on the face of the hand wheel, and subdivide this for the length required for an inch. The manner of obtaining duplicates with this machine was exceedingly simple. First, a perfect inch was got, and then a second was made, by means of the gravity piece; after which, all other sizes up to 100 in. were readily obtained. These sizes were now kept as duplicates. The finer dimensions were read from the divisions on the wheel, and from these, gauges for use in the workshop were made. All dimensions were thus duplicate multiples, or divisions of an inch, and a bare 1-16th in. became not an unknown quantity, variable with the rule or the eye of the workman, but so many thousandths of an inch, which were stamped on the gauges, and were soon understood. One of the first applications of the system in the workshop was to establish the necessary degree of tension required to ensure a perfect fit of a wheel on its axle. The result of experiments showed that with a difference of ·005 of an inch in the dimensions, there was a small permanent set in the wheel boss, but with a difference of ·003 of an inch the set was hardly perceptible. It was found, however, that, with ordinary lathe work, ·003 was rather too fine a dimension, as lathes were seldom exactly true in their spindles. The size ·005 was then finally adopted. In shrinking on outside cranks it was found that that ·015 was sufficient to retain them in their places, while cross-head spindles 2½ in. diameter required a difference of ·004, and levers with 3 in. holes of only ·001.

The gauges were described, as well as the manner in which the lengths of the eccentric rods were preserved uniform, and how the key groove in the outside cranks and the eccentric key grooves were cut. No setting out was required, and there was no chance of mistake from the carelessness of workmen. Unless the cranks and eccentrics were exact, they would not fit the tools, and thus a certainty was attained in the depth and position of the key groove.

Considerable improvements had been effected of late years in plate moulding, and the plan adopted at the Midland Railway Works at Derby was believed to be the first application of the system to such large and complicated castings as locomotive cylinders. Moulding boxes for axle brasses were exhibited, and a description was given of the manner of moulding cylinders. By this mode, a minimum quantity of sand was used, the projecting pieces cast on the boxes did away with the necessity of lifters, the castings came cleaner from the sand, the patterns were not knocked to pieces by rapping, and the cylinders were perfectly true in the bore and passages.

The plan of fitting together the various pieces, so as to ensure uniformity in erection as well as in detail, was then described; and it was urged, that by this system of accurate measurement, however large the parts might be, they became duplicates of one another, and could at any time be replaced. The advantages claimed were, economy in manufacture, greater excellence in workmanship, and a perfect system of duplicates, whereby the parts became interchangeable. The Author especially recommended this system to the Engineers of Indian and Colonial Railways, as there was no reason why the different parts of engines and of rolling stock generally, should not be as perfect duplicates as those of the Enfield rifle.

INTRODUCTION OF AN IMPORTANT NEW PROCESS INTO SHEFFIELD.

Many of our readers will be interested to learn that M. Simmolet, a French manufacturer, is introducing into Sheffield a new process of manufacturing scissors, which promises to revolutionise some departments of that trade. By the old process scissors are forged by hand. A flat narrow piece of steel of the requisite length and thickness for the size of scissor required is beaten on the anvil with a hand hammer into a rude approach to the shape required. The bow is made by punching a hole through the shank end, and hammering the steel thinner and wider until the requisite width is obtained. The ornamentation of the shank has to be produced by the hand-file—a long, laborious, and therefore expensive process. After all this labour has been expended upon the scissors, they are sent to the grinders to be put into shape. Even the filer leaves the scissors very rough and uneven, and the grinding is consequently a laborious operation. By the new process, a great portion of the labour we have indicated is saved. Commencing with the narrow piece of steel, M. Simmolet first chips slight pieces out of the shank by a single stroke of a machine. Another piece is struck out of the centre of the shank end, and by the simplest process possible—the introduction of a sort of wedge—the hole thus made is enlarged into the bow. Then comes the simple process by which the old plan of forging is superseded, filing is nearly done away with, and the grinders' labour is materially diminished. Dies of the precise size and shape of the scissor required are fixed in a steam hammer. The scissor is placed upon one die fixed on the anvil of the hammer, and is struck with a corresponding die fixed to the face of the hammer itself. By this simple and ingenious process scissor after scissor is forged almost by a single blow. The object of forging scissors is, by compressing the pores of the steel, to impart that hardness, tenacity, and elasticity—in one word, that "temper" on which the value of the scissors, as a cutting implement, depends. We are assured that this result is attained even more perfectly by M. Simmolet's steam hammer and dies than by the hand hammer of the forger. The forger hammering first one part of the blade and then the other, often tempers one part better than the other; but by the use of the steam hammer perfect uniformity of temper is obtained throughout. As a question of temper, the machine-made scissor is at least equal to the one made by hand from the same quality of steel. In every other respect it is superior. In the first place the bows and shanks, as well as the blades, of machine-made scissors are perfectly uniform, and perfect uniformity cannot be secured by the hand hammer, where the workman has to be guided by the eye. In the next place, the ornamentation of the bow is produced by the same stroke that forges the blade. However elaborate the ornamentation required, it has only to be inserted in the die, and is reproduced in perfection in the scissor. Thus the long and laborious operation of filing the straight or slightly curved bow into a highly ornamented one is not only saved, but improved upon. The scissor comes from the machine with a narrow flange on each edge. The greater part of the flange is cut off by machinery, and the hand file is required only to round off the edges from which the flange has been cut. The steel, moreover, comes from the steam hammer a smooth and perfect scissor as regards shape. There is no unevenness of surface to be ground down; only polish and edge is required, and therefore the work of a grinder is obviously much less than in hand-forged scissors. Hand-made scissors have to be made in pairs, and require great care and labour in fitting. But scissors made by these machines are so perfectly uniform that any two taken promiscuously from a heap fit together as a pair without the least adaptation, and M. Simmolet's invention provides for the riveting by a process as simple as its predecessors. The total result is this:—The machine-made scissors are in bow, shank, and blade perfectly uniform; the bows are rounder and smoother inside than those of the hand-forged scissors, and are consequently much more agreeable to the fingers in use; the quality of the blade is equal to that of the hand-forged scissors if the same quality of steel is used; moreover, scissors entirely devoid of ornamentation can be produced cheaper by machinery than by hand; and ornamented scissors can be produced at greatly reduced prices. M. Simmolet's process is already in successful operation in

France, and producing scissors superior in finish and general appearance to those of English make as regards the bows and shanks—the ornamental part. The French grinders are, however, less skilful than those of Sheffield, and French manufacturers cannot equal those of Sheffield in the quality of their steel. English scissors are, consequently, superior in the blade; French scissors, in the bow and shank. By introducing his patent here, M. Simmolet offers Sheffield manufacturers an opportunity of combining all the excellencies of the French and English scissors, without the defects of either, and at a lower price than either. Such are the merits claimed for the new invention. If in the actual result those claims are substantiated, the question obviously arises, can Sheffield hope for any length of time to retain the scissor trade at all, unless her manufacturers, by taking advantage of the new process, put themselves in a position to keep ahead of their foreign rivals? We will now only add that those of our manufacturers who best know the invention believe it to be valuable.—From the *Sheffield Independent*.

BARNINGHAM'S IMPROVEMENTS IN THE PERMANENT WAY OF RAILWAYS.

FIG. 1.

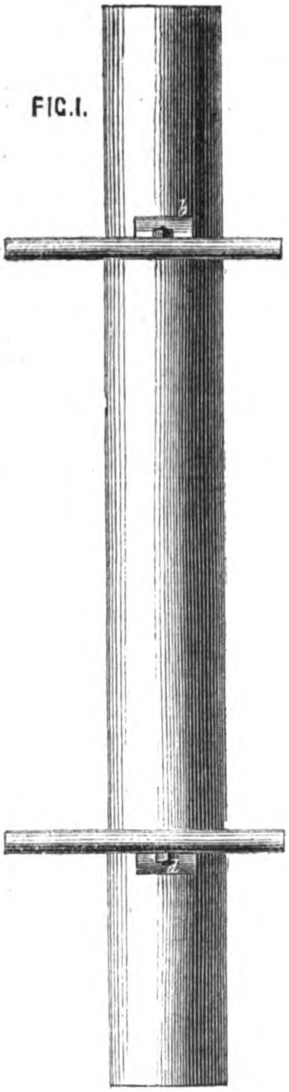


FIG. 3

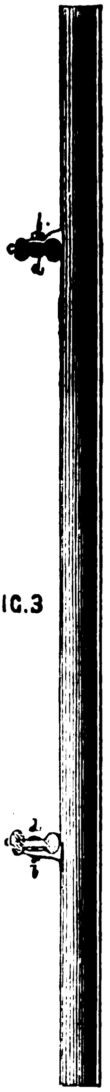
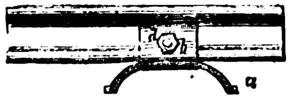


FIG. 2.



ACCORDING to this invention, lately patented by Mr. Barningham, of Pendleton Iron Works, near Manchester, railway sleepers, either transverse or longitudinal, are made of wrought iron, rolled to a semi-elliptical or other suitable form, to combine strength with lightness, and of sufficient area to be firmly supported on the ballast. The rails are attached by bolts or otherwise to chairs or half-chairs, which are welded, riveted, or bolted to the sleepers, or the chairs may be formed of strips of metal cut from the top of the sleeper on three sides, and bent into the required form to suit the shape of the rail. When bridge or other flat-bottomed rails are employed, they may bear upon, and be connected to, the sleepers by bolts or rivets. Fig. 1 is a plan of the improved wrought-iron sleepers with half-chairs welded thereon; fig. 2 is a side view; and fig. 3, an elevation of the same; *a*, *a*, are the wrought-iron sleepers, rolled of a semi-elliptical form, or semi-circular or other suitable form, to combine strength with lightness, and of sufficient area to be firmly supported on or by the ballast; when the sleepers have been rolled, they are cut off to the required length by a circular saw or otherwise, and they are then ready to have the half-chairs *b* welded to them, rails *c* are secured to the half-chair *b* by the bolts *d*. In welding the half-chairs to the sleeper the upper surface of the sleeper is slightly depressed, so as to form a level surface for the under side of the rail to bed upon, or the sleepers may be rolled with a flat surface on the top.

TANGYE'S IMPROVED DIFFERENTIAL PULLEYS.

FIG. 1.

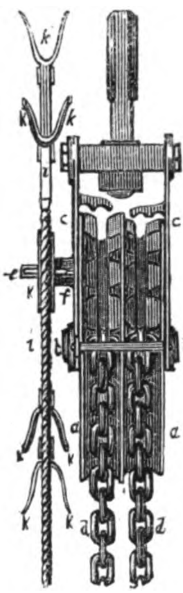
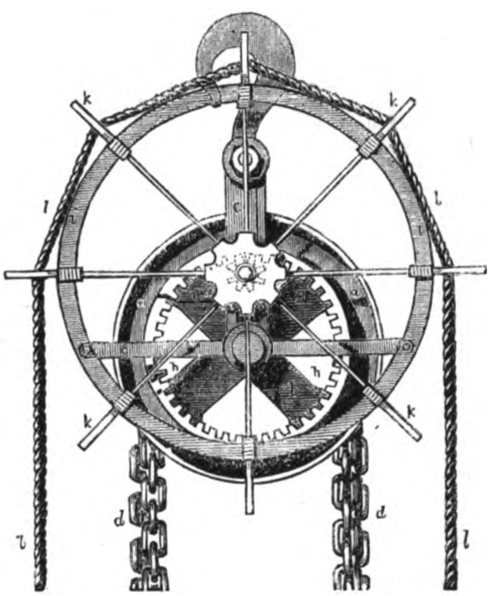


FIG. 2.



TANGYE'S IMPROVED DIFFERENTIAL PULLEYS.

THE following is a description of an improvement on Weston's differential pulley blocks, which has been lately patented by Mr. Tangye, of Birmingham. Mr. Weston's pulleys were described in the Specification of Letters Patent dated the 25th day of April, 1859, No. 1,033. By the use of the mechanical arrangements hereinafter described, these differential pulleys may be applied to the lifting of heavier weights than they can conveniently be applied to the lifting of as ordinarily constructed. To the axis of the pulley is attached a toothed wheel, with which toothed wheel a pinion on another and parallel axis engages. The axis of the said pinion carries a ratchet lever or winch with which to turn it, or is provided with a spocket wheel with an endless band passed over it for the same purpose. By giving a rotary motion to the axis of the pinion a slow motion is given to the differential pulley. By this invention differential pulleys may be made very powerful, without increasing the size of the pulleys to an inconvenient extent. Although a train of one toothed wheel and a pinion is sufficient for all ordinary purposes, yet multiplying gear consisting of a longer train of toothed wheels may be employed where it is desirable. The toothed wheel and pinion may either work within or without the frame carrying the pulley. Where the pulley is small the toothed wheel may be conveniently made hollow, the pinion taking into teeth on its inner surface.

Fig. 1 represents in front elevation, and fig. 2 in side elevation, a differential pulley, to which said pulley that form of this invention is applied. The same letters indicate the same parts in each figure.

a is the differential pulley turning on the axis *b*, the said axis being supported by the frame *c*; *d* is the looped endless chain of the differential pulley. Eccentric to the pulley, and parallel with its axis, is an axis *e* working in the bearing *f* carried by the frame *c* of the pulley. The axis *e* passes through the frame *c*, and has a pinion *g* on its end, which pinion gears with the teeth of the hollow toothed wheel *h* cast with the differential pulley *a*. Connected with the axis of the pinion *g* is a spocket wheel *i*, on the periphery of which the forks *k* are situated, between which forks an endless band or rope *l* is passed. By giving motion to the endless band or rope *l*, the spocket wheel *i* is made to rotate and communicate motion to the pinion *g*; the said pinion *g* gears with the toothed wheel *h*, and gives a slow rotary motion to the differential pulley *a*. Instead of the spocket wheel *i*, by which the axis of the pinion *g* is turned, the said axis of the pinion may be provided with a ratchet lever or winch with which to turn it. Although it is found convenient, in the case of pulleys of small diameter, to make the pinion gear with a hollow-toothed wheel inside of the pulley, yet the said pinion may gear with a toothed wheel the teeth of which are formed on the periphery of the pulley; or the said pinion may gear with a separate toothed wheel fixed on the axis of the pulley. In this last case, it is preferred to place both the pinion and toothed wheel outside the frame carrying the differential pulley. Instead of making the pinion on the axis which carries the spocket wheel, or ratchet lever, or winch, gear directly with the toothed wheel of the differential pulley, multiplying gear may be placed between the pinion and toothed wheel of the differential pulley.

SCIENCE EXAMINATION OF THE SCIENCE AND ART DEPARTMENT OF THE COMMITTEE OF COUNCIL ON EDUCATION.

THE annual May Examinations of the Pupils of Science Schools and Classes by the Department of Science and Art have just terminated, and the result shows a very satisfactory increase in the number of centres of examination, and the number of pupils who have come up to be examined; although in some subjects thete has been a decrease as compared with last year. In Geometrical Drawing the number of pupils examined in 1862 was 119, but this year they have increased to 289. In Machine Drawing the number has increased from 70 to 194; and in Building Construction there has been an increase from 45 to to 107. In Theoretical Mechanics there has been a falling off from 52 pupils to 35, and in Applied Mechanics the decrease is from 47 to 22. The Experimental Sciences appear the most popular. In Acoustics, Light, and Heat there is an increase from 47 to 121; and in Magnetism and Electricity the increase is from 105 to 207. Inorganic Chemistry shows an increase from 558 to 579; and Organic Chemistry an increase from 105 to 157. It is rather remarkable that there should be a falling off in some of the Natural Sciences. The number of pupils in Geology has decreased from 189 to 129, and in Mineralogy from 81 to 46. There is a slight decrease in Animal Physiology from 349 to 343; but in Zoology the decrease is from 84 to 41. In Vegetable Physiology there is an increase from 66 to 126, and in Systematic Botany from 26 to 84. In Mining and Metallurgy, which has been lately added to the list of subjects, there were 29 pupils in the former and 63 in the latter. The centres of examination have increased from 54 in 1862 to 71 in 1863; and the number of pupils examined in the different subjects has increased from 1,943 to 2,762. These figures only give an approximate estimate of the number of pupils receiving instruction in Elementary Science because a considered proportion are not sufficiently advanced to attend the examination.

South Kensington Museum, May 26, 1863.

MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM-BOILER EXPLOSIONS.

At the last ordinary monthly meeting of the Executive Committee of this Association, held at the Offices, 41, Corporation-street, Manchester, on Tuesday, May 26th, 1863, Mr. L. E. Fletcher, chief engineer, presented his Monthly Report, of which the following is an abstract:—

During the past month, there have been examined 257 engines—1 specially; 420 boilers—10 specially, 11 internally, 77 thoroughly, and 322 externally, in addition to which one of these boilers has been tested by hydraulic pressure. The following defects have been found in the boilers examined:—Fracture, 8 (3 dangerous); corrosion, 22; safety-valves out of order, 1; water gauges ditto, 11; pressure gauges ditto, 6; feed apparatus ditto, 2; blow-out apparatus ditto, 3; fusible plugs ditto, 1; furnaces out of shape, 2 (1 dangerous); over pressure, 2 (both dangerous); blistered plates, 2 (1 dangerous); total, 60 (7 dangerous). Boilers without glass water gauges, 2; without pressure gauges, 5; without blow-out apparatus, 17; without back pressure valves, 34.

The occurrence of explosions during the past few months has been so frequent, that the reports of their details have prevented any notice of the defects found to exist in the boilers under inspection, further than that given in the monthly lists as above; and, therefore, the present opportunity may be taken for some slight amplification.

Serious cases of corrosion continue to be met met with at the bottom of those boilers which are set upon brick mid-feathers, running underneath them from one end to the other along the centre or keel line. In this mode of setting, any water which may fall upon the boiler, or leak from the seams, trickles down the shell, and settles on the top of the mid-feather, in contact with the plates. Also were damp exists in the flues, it easily rises through the mid-feather and reaches the boiler. Corrosion may be going on along the centre of the mid-feather and not be visible at the sides, and thus pass undetected even on careful examination—several instances of which have recently been met with.

In one case, a boiler, 10 ft. 5 in. in diameter, and of plates 7-16ths thick, was found, upon the removal of the brickwork, to be deeply channelled for a width of 6 in. along the bottom at the centre of the seating, no indication of which was given at the sides of the wall, nor was it detected by hammering internally, but remained unknown until the removal of the brickwork. In another boiler, the shell of which was 8 ft. 2 in. diameter, and ⅜ in. thickness, the plates were found to be channelled longitudinally along the centre of the mid-feather for a width of 8 in. The seating was 15 in. wide, and the channel died out at 3 in. from the outside, thus giving no external sign. In a third boiler, the flues of which were damp, the whole of the plates in contact with the mid-feather were found to be corroded and as much as a quarter of an inch in thickness eaten away. Other instances might be adduced, but the character of the injury is so similar in each case that it would be tedious. Those already given will show the grounds upon which the following recommendations are made:—

1. Wherever it is practicable to do so, dispense with mid-feathers altogether, and substitute what are termed two side walls for them. 2. In those cases where the small size of the boiler forbids this, make the bearing surface of the mid-feather wall as narrow as possible. 3. Any that must be retained in use, should, in preparation for annual "thorough" inspection, be removed—at least where in contact with the transverse seams of rivets—in order to admit of complete examination.

Further cases of corrosion may be mentioned occurring to other boilers than those set upon mid-feathers.

A tubular boiler, without any external flues, was found so deeply channelled at the bottom of the shell at the transverse seams of rivets, that the plates were reduced to the thickness of a sheet of paper, and a hole knocked through them in sounding their strength with a hammer. A second boiler, of ordinary double furnace, internally-fired construction, was so eaten away by corrosion at the first bottom plate from the front, that, as in the preceding case, a hole was made on examination; the corrosion being due to leakage from the glass water gauges, and mudhole joint, as well as to the practice of slacking the ashes while lying at the front of the boiler. In another case, where the cross wall below the front end of the boiler was as much as two feet in thickness, the plates were corroded nearly through. So great a thickness as 2 ft. for these walls is quite unnecessary, as well as objectionable, and it is recommended that they should be removed periodically for the examination of the plates.

Several cases have been met with during the past month of injury occurring to externally-fired boilers at the parts immediately over the furnace, the plates bulging, cracking at the rivet holes, and the seams straining and leaking. One of our members has contributed a sample plate cut out from a boiler of this class, which is bulged down at the solid, and cracked completely through, although the boiler was amply supplied with water; this plate is a fair sample of the danger of the externally-fired class, and lies at the office for the inspection of members.

A safety-valve, the spindle of which passed through a bushed hole in the cover, was found to fit so tight as to be quite fast. This bush had been fitted to prevent the inconvenience arising from the escape of steam, under the impression that a safety valve was unnecessary, as long as the boiler was provided with a steam pressure gauge.

Explosions.—A report relative to Explosion No. 9, recorded in the last month's abstract, has since been received from an engineer who examined the boiler shortly after the explosion had occurred, and from which it appears that the boiler, which was of plain cylindrical egg-ended construction, and externally-fired, had rent—as is so constantly found to be the case in this class—at the transverse seams over the fire, the shell dividing into two parts, which were thrown some distance asunder. One boiler only, and which was not under the inspection of this association, has been reported to have exploded during the last month; the explosion occurring at too great a distance from Manchester to admit of a personal investigation. Should any particulars of interest be ascertained, they will be communicated in the next monthly report.—The explosion will rank as No. 10 in this year's list.

Up to the 13th of last April no less than 7,402,339 gallons of petroleum had been shipped from New York to foreign ports. London and Liverpool are the two great receiving ports of American petroleum—over 1,000,000 gallons having been sent to each of these places at the date stated. In addition to the above, 3,353,608 gallons have been shipped from Portland, Boston, Philadelphia, and Baltimore, making a total of 10,755,947 gallons. The petroleum trade with foreign nations has already attained to gigantic proportions.

PALSER'S PAPER PULP APPARATUS.

The improved machinery for manufacturing paper pulp, illustrated on the next page, has been recently patented by Mr. J. B. Palser, of Holborn. The object of this invention is to reduce straw and other fibrous materials to pulp in an economical and expeditious manner. The process may simply be described as the subjecting of straw and other fibrous materials to to the action of an alkaline solution in rotating boilers, under the pressure of from 110 lb. to 130 lb. to the inch or thereabouts.

In the accompanying engravings, fig. 1 represents a sectional elevation, and fig. 2 a partial section, of the apparatus employed in carrying out this process.

A, A, is a reverberatory furnace for supplying heat to a pair of cylindrical boilers B, B, which are intended to receive the stock or material to be operated upon, and are capable of rotating on their axes. The boilers are mounted in separate compartments, constructed of brickwork, and communicating by means of separate flues, with the furnace A. Above these boilers, and supported by the walls of the compartments, evaporating pans or vats E, E, are mounted, which are respectively brought into communication with the boilers by means of a suitable arrangement of pipes, to be presently described. The pans E, E, are intended to receive the alkaline liquor which has been used in the treatment of the fibrous materials, and to assist (by evaporating the watery particles) in the recovery of the alkali. The bottoms of the pans E, E, are pierced with holes at suitable distances apart, and these holes are capable of being closed by plugs, the plugs in each pan being attached by chains to arms carried by a rock shaft *a*, which has its bearings on the ends of the pans. These holes are intended to discharge the liquid from the pans on to a hearth below the boilers, allowing it in its passage to flow over the rotary boilers, and thereby utilizing the surface heat of the boilers. The rock shafts are weighted, as shown at fig. 2, to ensure their retaining the position into which they are rocked. Within the division wall of the chambers a longitudinal passage or flue is formed. This flue is employed for heating air, which is forced therein by a blowing engine, and is led off thence in a heated state by a pipe at the other end of the flue to branch pipes. These branch pipes conduct the air upwards into the vats or pans, and discharge it into the liquor contained in the pans through a number of small holes made in the portions of the branch pipes which lie on the bottom of the vats. By the discharge of air into the vats, the evaporation of the liquor contained therein is materially accelerated. Through the flue a water pipe *e* passes, which leads from a reservoir of water, or it may be alkaline liquid, placed on a higher level than the boilers, the object being to heat the liquid on its passage to the boilers. The pipe *e* on its exit from the flue is divided into two branch pipes, which turn respectively into one of the boilers through fixed hollow stud axles on which they are mounted. At the opposite end of the boilers to that at which the branch feed pipes are situated is an arrangement of steam pipes *f*, *f*, connected with the hollow fixed axles of the boilers, for the purpose of conveying steam thereto, either from an adjacent steam boiler or from one boiler B to the other, according to the stage of the process at which the steam pipes are brought into use. These pipes are fitted with faucets for changing at pleasure the direction of the flow of the steam. The axles are divided longitudinally by a partition, as shown in the enlarged sectional view, fig. 3 and leading from these passages, near the inner and closed ends of the axles, are lateral pipes, as shown. These pipes, are intended for supplying their respective boilers with or exhausting them of steam, and also for withdrawing the liquid therefrom. The pipes, which extend to the lowest part of the boilers, form a vent for the liquid at the end of the process for preparing the pulp, the liquid being forced out through them by the pressure of the steam in the boiler and discharged into the vats above, or the liquid may be otherwise directed as thought desirable. The pipes for discharging the liquor and admitting and discharging steam are separated from the "stock" in the boilers by vertical perforated partitions *g*, and thus they cannot be broken or even bent by the pressure of the revolving "stock," nor can they be closed by solid matters accidentally forced into them. The partitions serve also as strainers for retaining the "stock" in its own compartment, and yet permit the drawing off of all the liquid matters at any desired time during the operation hereinafter to be described.

In order to economize to its full the heat of the reverberatory furnace, the liquid is discharged from the pans alternately, by means of pendent pipes on to the boilers. Dampers are provided for closing the flues, and thus diverting at pleasure the course of the gases of combustion from the furnace to the boilers. These dampers can be alternately raised and lowered, in order that the heating of one boiler may be proceeding while the other is cooling.

When straw is the material to be operated upon, it is first cut into suitable lengths, subjected to a winnowing process to cleanse it from dirt, and then crushed between a pair of iron rollers. The straw thus prepared is ready to be acted upon in the above apparatus. Supposing one of the boilers to have been emptied of its contents while the operation of boiling under a high pressure was proceeding in the other boiler, and that this boiling is just completed, things are ready for a repetition of the operation, which is conducted as follows:—The empty boiler is filled with the prepared straw or other substance through a man-hole *k*, and the man-hole is then closed. A solution of caustic alkaii, of a strength indicating from 3½ deg. to 3¾ deg. Beaumé, is next run into the boiler in the proportion of about 60 gallons of the liquor to every 100 lb. of the cut straw, and the boiler is set in rotary motion by means of suitable driving gear connected with the spur wheel *l* affixed to the outer extremity of the boiler. The fire heat is now cut off from the adjacent boiler by dropping its damper, and admitted by the raising of the other damper to the boier last charged with fibrous material. Steam from the heated boiler is also turned into it until the temperature and pressure are equal in both boilers. This operation is important, as the means of raising the temperature in the one boiler is expedited, while the cooling of the other boiler is also facilitated.

PALSER'S PAPER PULP APPARATUS.

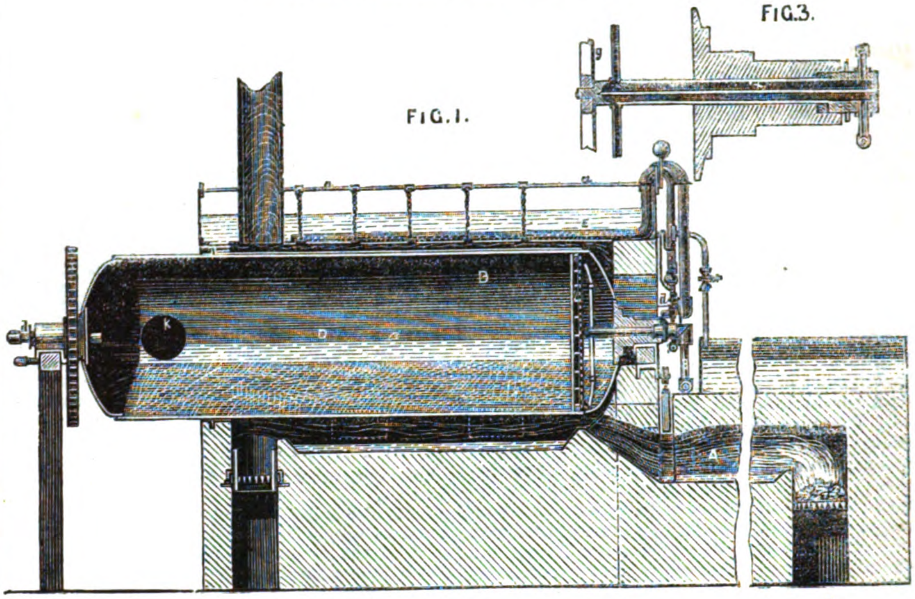


FIG.3.

FIG.1.

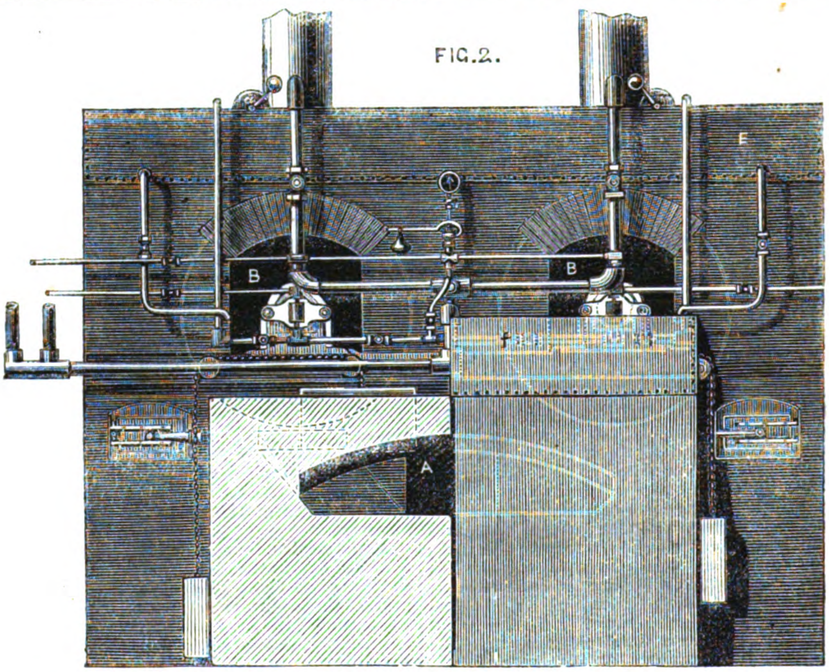
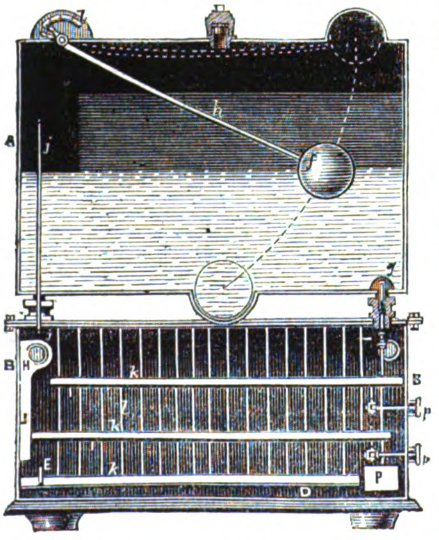


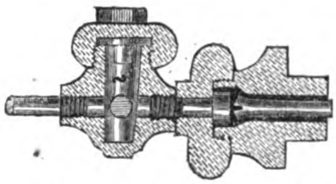
FIG.2.

BROOMAN'S CARBURETTING GAS APPARATUS.



THIS apparatus, recently patented by Mr. Brooman, on behalf of Messrs. Bricout and Berlet, of Reims, France, may be divided into three parts, consisting—1, of a vessel or reservoir for containing the carburetting liquid; 2, of the carburator proper, fed by the first-named vessel; and, 3, of certain valve and tap arrangements, all as hereafter described.

A is the vessel or reservoir for containing the carburetting liquid, and B is the carburator proper. The reservoir A is placed above, and is independent of the carburator B, and can be removed from it to be supplied with liquid. The reservoir A consists of a vessel, by preference of zinc, with an aperture at top for the introduction of liquid, which is hermetically closed by a capsuled stopper. The reservoir A is supplied with carburetting liquid, as required, by a portable reservoir put in communication therewith by the aperture. The reservoir communicates at bottom with the carburator B by means of a tube, the mouth of which is covered by metallic cloth *g*, to filter the liquid as it flows out. The reservoir is supported on feet, which rest on the carburator. There is an air tube *j*, leading from the carburator B to the reservoir A, passing when the latter is fixed to the carburator, by preference, through one of the feet, and extending to near the top of the reservoir, but when the reservoir is not attached to the carburator, the air tube *j* is replaced by a gas-pipe. The carburator B is supplied with liquid from the reservoir A by means of the tube and a valve arrangement, hereafter described. It is divided by partitions *k*, *k*, *k*, into three compartments, each of which forms a small vessel, the depth varying according to the size of the apparatus. These vessels are fitted with cotton wicks *l*, extending vertically the whole depth, or nearly so, of the apparatus. In the two upper compartments the level of the liquid is regulated by two small tubes, which into the lower vessel. There is a safety compartment D at the bottom of the carburor, at which, carry the overflow from one into the other, and through a tube E, receives any excess of liquid that may be produced. The gas, after having passed through a tap of peculiar construction, reaches the carburator B through a pipe H, and descends by another pipe I to the lower part, where, after having traversed in a zig-zag direction the three compartments fitted with wicks, and thus becoming enriched, issues from the apparatus by another pipe K provided for that purpose. To empty the carburator B, first open the interior tap or taps below the upper vessels, by means of the buttons *p*. When two taps are employed, as shown in the drawing, each of the the vessels *k*, *k*, is provided with a tube. When only one tap is employed, it is furnished with two apertures, each leading to one of the said vessels. The valve arrangement is composed of three principal parts: a tube, a tap, and a valve. The tube is connected to the reservoir A, and terminates in an enlarged head, fitted so as to hermetically close the valve chamber; the tube is fitted at its upper part with a tap *s* (see the detached view), which must be closed whenever the reservoir A is removed. The valve proper is formed with a conical head fitting into a conical seat; the conical head is formed on a rod screwing into a spring *v*, which exerts a strong pressure from top to bottom, and thereby keeps the valve closed. A weighted float P, connected to a lever free to oscillate upon a fixed point, imparts to the valve an upward motion, and exerts sufficient power to overcome the resistance offered by the spring *v*, whereby the valve is opened, and passage is allowed to the carburetting liquid until a certain level is attained in the vessels *k*, *k*, in the carburator B, then the float in rising ceases to keep the valve closed, when the spring *v* acts to keep it on its seat, and thereby closes and stops communication between the carburator B and reservoir A. In order to show the quantity of carburetting liquid contained in the reservoir A, a float is used for indicating the level of the liquid in the reservoir. The rod *h* of a float *f* is attached at its extremity to a pointer in front of the indicator.



HUMPHRYS' IMPROVEMENTS IN STEERING APPARATUS.

Mr. Edward Humphrys, of Deptford, has lately patented some improvements in steering apparatus, and his invention consists in so combining apparatus for acting by hydraulic power on the rudder of a ship or vessel that the hydraulic cylinder and other apparatus intermediate of it and the rudder may be all below the line of flotation, and consequently out of the way of shot. For this purpose an arm or projection is fixed to the rudder sufficiently below the water line to protect it from shot. This arm is suitably connected to the piston rod of the hydraulic cylinder, which is also situated below the water line of the ship or vessel. A stuffing box is formed through the stern of the ship or vessel for the passage of the piston rod or of a connecting rod, so that the communication between the piston of the hydraulic cylinder and the rudder may be water-tight. The arrangement for working the hydraulic pumps and apparatus may be according to the means at present in practice or otherwise. Fig. 1 shows a side view of the rudder and part of the sternpost of a vessel, the rudder being combined with hydraulic apparatus; the hydraulic apparatus in this figure is shown in section. Fig. 2 shows a horizontal section of the same, the section being taken through the centre of the hydraulic cylinder. In the arrangement shown in the drawing, the rudder *a* has fixed to it an arm *b*, the arm being sufficiently below the water line to be protected from shot; this arm is pin-jointed to one end of a connecting rod, which at its other end is pin-jointed to a cylindrical slide *c*; this slide can traverse to and fro in a guide tube *d*, lined with brass; the cylindrical slide *c* is also pin-jointed to the end of the piston rod *e* of a hydraulic cylinder *f*. The piston rod *e* passes out of the end of the guide tube *d* through a stuffing box *g*; one end of the guide tube *d* passes through the skin of the vessel, and the flange of the guide tube is bolted thereto; its other end is supported from the deck *h*, upon which the steersman who works the hydraulic apparatus stands. In the arrangement of hydraulic apparatus shown in the drawing, water under pressure can be admitted to either side of the piston by moving the slide valve *i* by means of the lever *k*. This is an arrangement now well understood, but other arrangements of hydraulic apparatus may be employed in place of it.

In ships built with very low overhanging "counters," in place of passing the piston rod of the hydraulic cylinder through a stuffing box, as above described, the spindle of the rudder may be passed through a stuffingbox packed in the usual manner to make it water-tight, and the hydraulic cylinder together with the parts connected with it is then placed above this stuffing box, but still below the line of flotation of the vessel, the piston rod of the hydraulic cylinder being by preference connected by a connecting rod directly with an arm on the rudder spindle.

HUMPHRYS' IMPROVEMENTS IN STEERING APPARATUS.

FIG. 1.

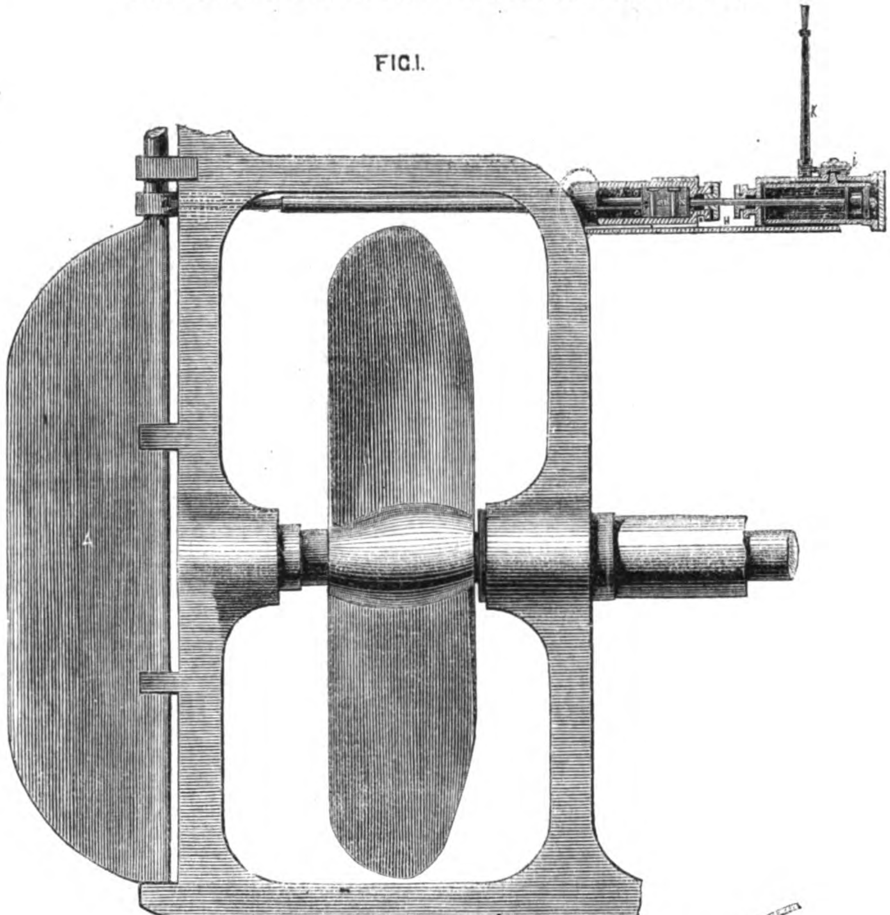
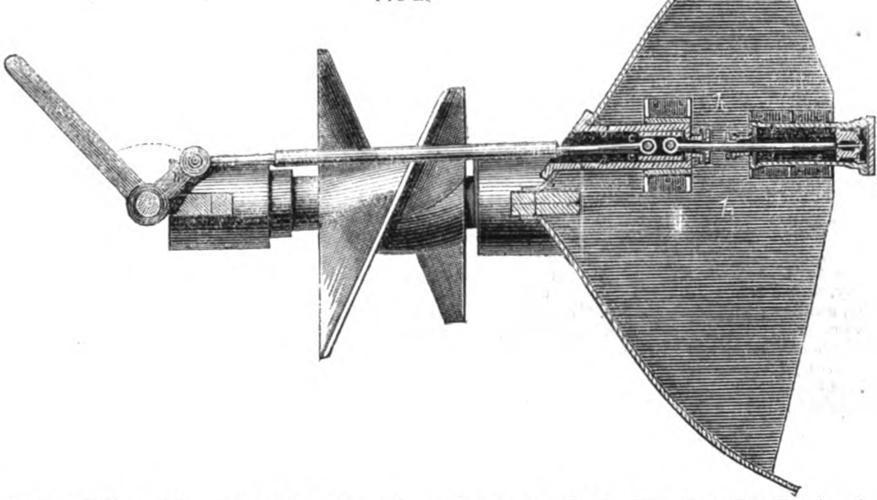


FIG 2.



California Flax.—The editor of the Los Angeles *News* has been furnished by Dr. Osborn, of that place, with a parcel of native flax, which grows wild and is said to be abundant in that section. The *News* says it is from a stock which appears to be a species of nettle; in texture there appears to be no material difference between it and common flax. It is thought that this plant might be successfully cultivated. The fibre is quite as fine and strong as a cultivated article of real flax.

Some ingenious German has invented a paper cup which will completely hold a draught of the hottest liquid, and can be bought for a *pfenning*. By means of this invention the good people of Berlin take up and drink at their ease, as they go along the railroad, the cups of coffee which the comfort-loving Englishmen find it impossible to swallow without scalding their throats.

Meetings for the Week.

MON.—*British Architects.*—At 8 p.m.
United Service Inst.—I. "On Naval and Military Signals," by P. H. Colomb, R.N. II. "On the Swords of the International Exhibition," by John Latham, Esq., at 3.30 p.m.
Royal Inst.—General Monthly Meeting, at 2 p.m.
TUES.—*Inst. Civil Engineers.*—President's Annual *Conversazione*, at 9 p.m.
Royal Inst.—"On Sound," by Prof. Tyndall, at 3 p.m.
WED.—*Soc. of Arts.*—"On the International Exhibition of 1862," by William Hawes, Esq. H.R.H. the Duke of Cambridge, K.G., will preside at 8 p.m.
THURS.—*Royal Soc.*—Election of Fellows.
Chemical Soc.—At 8 p.m.
Linnæan Soc.—At 8 p.m.
Antiquaries.—At 8.30 p.m.
Royal Inst.—"On Geology," by Prof. D. T. Ansted, at 3 p.m.
FRI.—*United Service Inst.*—"Telescopes and Opera Glasses for use in the Field or at Sea," by Alex. Strange, Esq., at 3 p.m.
Royal Inst.—"On the Alps of Savoy," by J. Ruskin, Esq., at 8 p.m.
Architectural Exhibition.—Class of Design—Public Memorial.
SAT.—*Royal Soc.*—"On Electric Telegraphy," by Prof. W. Thomson, at 3 p.m.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

RECEIVED.—F. R.—S. H.—R. T.—V. P.—J. H. P.—S. T.—Capt. S.—B. C.—W. R. T.—W. R.—J. H.—S. and Bros.

PHILO—Thanks. Want of space compels us to decline inserting any more letters on this question at present.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

◆

MALLET'S FOLLY.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—In your impression of the 15th inst., p. 361, I remark an article under the above title, copied apparently from a Dublin newspaper, the *Freeman's Journal*, which commences thus:—"One of the most promising (prominent is meant, perhaps) objects in or near Dublin was Mallet's Folly—a huge, oblong building, standing upon the north bank of the Royal Canal. It was built by an Irishman named Mallet, who signally failed in his speculations. Since then Mallet's Folly has been falling into decay, and for a long time has been the home of bats, swallows, and ivy. Messrs. Murtagh Brothers have recently restored the building in a most remarkable manner, and what was known as Mallet's Folly is now known as the North City Flour Mills."

The remainder of the article appears to be an advertising "puff oblique," in the usual "penny-a-line" style, and without any obvious interest to your readers.

My father, Mr. John Mallet, is no doubt the person libelled in the paragraph I have quoted; and, as your respectable pages have given currency to this most causeless and disreputable calumny, of an old gentleman now in his 84th year, I presume you will permit me to contradict it by affirming that everything having reference to my father, or to any one of our name, in the article in question, is absolutely false; indeed, the above paragraph contains a separate falsehood in almost each line.

My father is not an Irishman—nor is there Irish blood in any one of our name. He was never a speculator. So far from having signally failed in his transactions—he went to Ireland from Devon in 1800, and, for nearly fifty years, is well known by numbers now living, to have been one of the most prosperous traders and respected citizens of Dublin, one of the easiest proofs of which is that he expended above £10,000—every shilling of which came from the profits of his business—upon the concern referred to.

"Mallet's Mill" was the name it popularly bore; it was never known as "Mallet's Folly." The building had never fallen to decay—the "bats, swallows, and ivy" are simply items of decorative mendacity—having been raised to its full height and roofed in only in 1848 (as the date graven on its stones proves), so it was not "restored in a remarkable manner since."

My father's original destination for it—a rolling mill for lead—having been changed by circumstances affecting that trade with which I need not trouble you, the floors were purposely not completed. The premises, however, were occupied and worked, by the late firm of John and Robert Mallet for several years prior to 1852 as a large forge and iron foundry, auxiliary to their other works, and from them, nearly the whole of the permanent way (except rails) of the Great Southern and Western, the Midland, the Belfast and Ballymena, Ulster, and the other Irish lines, as well as great quantities of other railway plant, were turned out.

The concern, then the joint property of my father and myself, and perfectly unencumbered, was, by our direction, sold some two or three years ago, after we had thought proper to break up all our manufacturing establishments in Ireland. Some one of the name of Murtagh, in the flour trade, was, I believe, the purchaser.

"The moral" drawn with proverbial inconsecutiveness, from this libellous puff, concludes in these words:—"It will teach a lesson to all Irishmen to be self-reliant, true to themselves and to one another, and to leave no Mallet's Folly at which the finger of the scorner can point."

Self-reliance and truth are certainly rare virtues in Ireland—few, however, here at least, will deem the former evinced by newspaper puffing based on calumny, or the latter promoted by lying. None but those who have had opportunity of knowing intimately the social inner life of that country will guess, that it is probably to the facts that my father is English, and dwelling in Ireland in troubled times, never forgot either his allegiance or his Protestanism, and that, while High Sheriff of Dublin, it was his duty to conduct O'Connell to gaol for sedition—that the *animus* of the ultramontane *Freeman's Journal* scribe has thus taken occasion to libel him.

I regret to have had to occupy your pages with matter of so little import to your readers.

Yours obediently,
ROBERT MALLET, M.I.C.E.
The Grove, Clapham-road, London.
May 25, 1863.

[We are sorry that anything which appeared in our pages should have been incorrect, or should have in any way wounded the feelings of Mr. Mallet. The *Freeman's Journal* was our authority for every statement we made.—ED. M.M.]

ELASTICITY IN THE BACKING TO ARMOUR PLATES.

SIR,—I have read with interest the account in your last week's publication of Mr. George Clark's system of iron cellular backing to armour plates. This is the system which your correspondent "Civilian" approves, and I suppose there exists the very best of reasons why it should meet his approbation; but, however that may be, as being founded professedly on the principle of rigidity, it coincides exactly with the views long advocated by him in your pages. We are now enabled to understand what is meant by that principle, both by the theoretical explanation given of it, and by its practical illustration; but it is astonishing to find that in neither of these aspects does rigidity mean rigidity, but elasticity after all. It seems that, without knowing it, there has been all along a deal of prose spoken under the illusion of an inspiration in the poetical vein.

We often meet with bad practice in connection with good principles; but here is an instance, more rare, of a good practical contrivance (barring one important exception, however) in connection with, and supposed to be an illustration of, a false principle. But that one exception is really in accordance with the assumed principle, and therefore spoils the whole affair—I allude to the position of the grain of the timber occupying the longitudinal cells, it being placed "end on." If Mr. Clark had arranged the timber, and of course the grain of the wood lengthwise, he would have added all its strength to the efficiency of his backing; but then he would have adopted Mr. J. Chalmers' plan, and, worse than all, he would have acknowledged the principle of elasticity and repudiated the darling fallacy of rigidity. And yet he would not more pointedly have committed himself—his inconsistency would not have been more glaring than it is already in adopting an iron cellular system for a backing, of which the purport is, he says, and says truly, to introduce "cohesion in every part of the structure," in order that "the projectile force meeting with no adequate resistance from the wood might be dispersed over an extended area, as it would be," he continues, which, however, is a *non-sequitur*, "if complete rigidity were maintained all over and through the structure." The correct sequence would have been, "as it would be in proportion to the extent in which the cohesion is maintained, in virtue of the range allowed to the elasticity in the structure." This explanatory admission, that the efficiency of the iron cellular system consists in a more extended area of resistance, necessarily lets in the principle of elasticity; for how can there be an extension beyond the area of impact of the shot, except through the medium of cohesion and the elastic force, these two standing also in the relation towards each other of the one being effect and the other cause?

It is the yielding of the part struck by the non-penetrating shot, or rather the part immediately under, which brings the cohesion and elasticity of the backing into play, and so makes all the surrounding parts contribute to the total resistance. If that part were perfectly rigid, that is immoveable, it must bear the brunt of the force of impact by itself, for "a dispersion over an extended area" is a physical impossibility unless it does move, and so induces motion all around, else no other cohesion will be concerned but that of the part itself. The implication of other cohesions is the function of elasticity, which can come into operation only through the medium of motion, either in the way of compression or extension. Elasticity manifests itself in a continuous cohesion of the molecules of matter, notwithstanding separation through small intervals of space; but that continuity is likely to be abruptly severed by a concentration of the action wholly upon the molecules immediately concerned, if a distance be not permitted over which the force can act by bending the material, and in so acting accumulate against itself the successive resistances of enlarging circles of cohesion. Thus it is, that, in this case at least, motion and elasticity are correlatives, and that motion and not rigidity is necessary for the development of strength. It may deserve remark here, by way of explanation, that resilience, which generally attaches to our idea of elasticity, is not necessarily an element thereof, it being simply a proof of the elastic force being uninjured by the violence of the impact. This force may be destroyed, but it opposes resistance to destruction; and therefore, though wood and iron may be crippled and deprived of resilience, we can still discuss about elasticity in its development as a force.

The simple fact is, that Mr. George Clark has substituted the elasticity of an iron structure for that of a timber one; and "Civilian" has confounded the greater intensity and smaller range of that elasticity with rigidity. In truth, there is no such thing as rigidity apart from elasticity, in any physical conception of it. It means a certain form of elasticity, in which the force of cohesion is great, and the distance to which it extends is small. Now it is competent for Mr. Clark and "Civilian" to contend, that the elastic force answers the purpose of backing better in the form in which it exists in iron, than in that in which it exists in wood, but by repudiating elasticity in principle, and therefore *in toto* if possible, they have fallen into this absurdity, that whilst actually employing wood, they have refused to appropriate its elasticity, and all the while have availed themselves of the elasticity of iron! Whether the one or the other is the best for the purpose is at present an open question, but I am inclined to think that a union of the two would be better than either separately. Such is the velocity of projectiles, that wood alone appears to be crushed to some extent, as well in the propagation of the blow as in the passage of the shot, before motion can be communicated to, and assistance received from, surrounding parts to any extent that would render available more than a small portion probably of their elasticity. A combination of iron with the wood would materially prevent the crushing, and give time for elasticity to have some degree of fair play; whilst the elasticity of the iron itself in a cellular arrangement, but which I do not think is the best, would be more efficient in point of range than in the armour-plates, by reason of a looser structure and a greater latitude of movement. The rigidity, or stiffness of elasticity, belonging to armour-plates, exposes them to a severe trial, first to resist penetration, and next, if successful in that, to prevent fractures, which will occur, not only in themselves, but in the rigid framing behind. To give them the best chance, would be not to let them have any backing at all, if that were practicable, but to combine them all into one shell, which may be either external to, or constitute the hull of the vessel; elasticity would then have some little scope for fair play. It is quite certain, in point of principle and mere theory, that in the case of a shot impinging on a surface, opposing at first only a slight resistance but a gradually ,increasing one throughout the recoil, such surface, whether of wood or of iron, need scarcely be penetrated at all; but practically, we cannot of course even approximate toward such a result. Such, however, is the principle, and it is false theory and unsound practice to run counter to it.

Yours, &c.,
Benjamin Cheverton.

P.S.—There was a typographical error in my last, of "this" for "thus," which materially injured the sense.

OCEANIC TELEGRAPHY.

Sir,—That combat is hardly a fair one, in which one party is defended by the impenetrable mail of an anonymous signature, while the other throws bare the breast of an unpretentious patronymic open to the attacks of his mailed adversary. I have, indeed, some doubts whether I might not say "scaly adversary," for only the man who, as the ballad has it, "was married to a mermaid," or has some such scaly connections, could justly assume the tone with which "H. K." rebukes me for not saying "I know," instead of "It is probable," when speaking of the bottom of the sea and the oceanic currents. If this be the case—if "H. K.," besides being what seamen call a land shark, has also the intimate knowledge of the recesses of the ocean, generally supposed to be the sole attribute of the sea sharks and their congeners, let him not lose a moment in proclaiming it, and I am sure that all seamen will at once resort to such an authority as we shall then acknowledge him to be.

But if, on the other hand, like a limpet, he has all his life stuck to the rocks of prejudice, and is quite sure that his own horizon bounds the world, he can scarcely expect men who began life by circumnavigating the globe, to agree with his views or to give up their facts in favour of his fallacies.

I feel highly honoured by, though quite unworthy of, the comparison of my views with those of Capt. Maury; and the fact of their accordance, though it subjects both to a common censure by "H. K.," is a source of gratification to myself.

Captain Maury is an officer who has spent a great part of his life in collating and comparing the facts registered by independent observers in all parts of the globe. Naturally, he does not give all the facts, but principally the inferences which he drew from them; but even if the theories he has based on such comparison and collation be not always capable of absolute proof in all cases, yet circumstantial evidence has long been admitted to be of no small value, though a clever lawyer may sometimes have transported or hanged an innocent man by trusting too much to it.

Does "H. K." really suppose that the few facts he has happened to hear or read of, bearing on the argument he has *now* undertaken, of ocean currents, are the sole evidence on the subject? If he will take the trouble to go to the Hydrographic-office, he may find currents, above and below, accurately registered for years past, in all parts of the world; information, comprising pages of observations on the Gibraltar current; volumes of evidence as to deep sea currents in other seas; and, as for surface currents, the strangest thing would be if he did not find a current course in every log—of almost every day—of each ship that ever sailed the ocean. Where, then, has he sought the evidence; on what does he base the assumption that seamen have no power of collecting facts, or assigning to them their just value? What has been his acquaintance with the sea, and its phenomena, that he can afford to treat an Admiral's facts with scorn, and a hydrographer's theories with ridicule? Did he qualify in a Margate hoy? Has he sailed in a Leith smack? Or may we find the place of his nativity in a bathing-box?

It must be—the north has often been the *locale* of such apparitions—he has had a mermaid as a *chere amie*, and she has told him all about it. She was not very well up in physics though, or she would have informed him what was the specific gravity of a barnacle. Perhaps, however, she had one sticking to her tail, and as *it* floated, when *she* floated, why its specific gravity was an idle tale, and not worth taking into consideration. One thing she certainly did not do, and that was to allow him the use of her mirror—

> Oh! wad some fay the giftie gie us,
> To see oursels as ithers see us!

But, as the manner of the times is, "H. K." wants no apprenticeship. At once he proclaims himself master. "Let who will learn—mine it is to teach. At least I can assert, and now-a-days very few will be at the trouble to answer or contradict." Were I disposed to engage in the task of convincing "H. K." of all his errors—for he has "shunted" into currents, and thereby confessed to an unmanageable friction (whether from icebergs or other things) in the cable-laying question—I would without much difficulty show that not one, but hundreds of confirmatory experiments have been made since that trio of facts, which he gratuitously supposes to be the only bases for the opinions held generally by seamen on these subjects. But, first, I may safely leave him in the hands of "An Old Sailor;" and secondly, I can scarcely doubt that the readers of your magazine will be quick to believe a writer, who evinces so little respect for, or knowledge of, the most ordinary physical laws, to be a very untrustworthy guide in the unknown regions of the vast deep—that expanse which, though I have long and widely traversed, I never yet have been through.

Of course, as I said before, if he "kens aught that's no canny," I'll eat humble pie at once, without any compulsion. Commander Dayman would, I am sure, be one of the last officers in the Navy to undervalue the labours of his senior officers, or to call his soundings and ideas the facts, in opposition to which, Captain Maury's, Sir Edward Belcher's, or any other hydrographer's were "groundless suppositions" and "imaginative speculations." I beg to assure "H. K." that when I got soundings, they were certainly not "groundless;" and as I have had the pleasure (?) of arranging some thousands of bits of the bottom, from deep-sea soundings made by Sir Edward Belcher when I was with him, I can testify that his were not so either.

Also that when a seaman is making observations for current, he is not left in doubt whether it be the boat or ship from which he observes, or the current log which he uses, that is in motion. There certainly may be, among persons whom seamen denominate land-lubbers, doubts about seamanship. It is easy to see why. These persons, or some of them, having a high opinion of their own knowledge, make the mistake of thinking that what they do not know, and cannot easily understand, is a myth or a falsity. "I know everything; I don't know this; therefore, there is no such thing—*Q. E. D.*" But I hope there is no great danger of any one in these days mistaking a will-o'-the-wisp for the lime light. So I bid "H. K." adieu; and whenever he leaves his fishy connections and his *incog.*, I shall be happy to introduce him to food for a lifetime in the observation and experiment line.

In the Hydrographic-office these only wait for some English Maury to collate the evidence they afford, and to deduce the valuable inferences which they, and they alone, can furnish. Not till this is done will the general public be aware of what has been done by hydrographers, or of what is, on these subjects, the special knowledge of seamen.

Meanwhile, the public may be assured that such special knowledge does exist, and that whether the problem to be solved be the laws of wave motion or telegraphic submarine communication, from seamen alone—though not from any and every seaman—will they obtain reliable theory or correct information.

Since writing the above, I have seen your last impression; and while I acknowledge the courtesy with which "H. K." thanks "Old Sailor" and myself for the trouble we have jointly and severally taken to refute his reasonings—or rather assumptions—I cannot find any cause to regret that in this letter I have rather used sarcasm than argument.

For when an opponent assumes that to be proved which is not admitted, and proceeds to reason further on such an assumption, a more rational tone is wasted on him, and ridicule is fairly incurred by such an antagonist.

I defy "H. K." to stretch a line over 2,000 miles, or even 500 miles of ocean, without making it bind itself to the bottom of the curvature of the earth—admitting that it were possible (which it is not) so to stretch it at all. If he tried the experiment I recommended with the result to which he alluded, he certainly did so under wrong conditions. Perhaps he strained the line or thread tight—a condition which, as I have said, would be utterly unattainable in practice; or else the thread he used only represented Manilla rope, and was of so light a nature as to float by itself. A telegraph cable, the lightest that would sink at all, or be kept under water between the buoys, would require at least 600 miles of moorings, besides buoys, on the scheme of "H. K."—that is, the buoys, must be not more than six miles apart—three times the depth. Now "Old Sailor" has graphically described a portion of the difficulty of managing these; and I may add that the time consumed in placing each buoy could not be less, and might be much more, than two hours—300 buoys at two hours per buoy = 600 hours. Only 25 days consumed in the operation, or we will say 12½ in each ship, besides the distance to be gone over. Where on earth, sea, or air, does "H. K." think the coals for such work are to come from, or has he a theory that any number of days' coal can be carried in a ship, or that we can coal at sea, in the middle of the at all times delicate operation of cable laying.

As to currents, I recommend now to "H. K." another experiment, which I think will satisfy any one who tries it fairly of the reason why surface currents in one direction should and do generate undercurrents in another and opposite. Let him take a globe of water or aquarium, and having disseminated in it any semi-floating particles in a state of fine division—bread crumbs will do, let him create a surface current by blowing on it, or a more easily visible current by means of a syringe having its nose under water. The flocculi will follow curves, whose tendency will be to increase in size as the operation is continued in one direction till the whole body of water is set in regular motion. The power generated by the mere difference of temperature in the ocean surface, 80 deg. at the Equator and 32 deg. at the Poles, would be sufficient to account for such currents as the Gulf stream, the Arctic current, the Spitzbergen current, and many others well known to seamen, even if the trade winds did not furnish us with another and probable auxiliary in the explanation. Wherever during centuries a force, as wind, has been acting in one direction on water, there will be an eventual forward motion of the whole body, decreasing, it is true, in velocity progressively downwards, but always compensated for by the flowing in of water from a distance; and the operation of the trade winds, the monsoons, &c., are as clearly known to be shown in this way as any physical fact in modern science. With regard to icebergs, I am sure that my friend Sir Edward Belcher would confess that Sir J. Ross's experience on that point is far better than his own. Sir J. Ross says (page 189, answer 3299 of the blue book to which as "H. K." refers), that by the time icebergs get as far south as Cape Farewell they are seldom more than 150 ft. above and 150, fathoms below the surface; and his whole evidence goes to show the great dangers incurred by even laying a cable through such regions, let alone keeping it suspended there. The explanation of the discrepancies between the actual and the calculated immersions referred to by Sir E. Belcher is probably to be found in the fact that such calculations ignore shape. Of course an iceberg in the shape of two cones, with their bases joined at the water-line, might float with six times as much below as above, but another of a more flattened shape generally, yet with a pinnacle of the same apparent height as the one first spoken of, would not float so deeply immersed. But, at any rate, Sir J. Ross did not rely on theory when he saw a whole line of icebergs aground on a bank, the least water on which was 60 fathoms.

I do not by any means admit that wire-rope is more suitable for "H. K.'s" moorings than chain. Rust and barnacles would more speedily destroy it, and it would be less manageable as ground tackle.

I utterly deny that barnacles will not add, and add largely, to the weight the buoys would have to support, or that you could beforehand calculate and provide for such extra weight. The most rudimentary knowledge of the components of shells, barnacle or any other, ought to have convinced "H. K." that this objection is a valid one, and that it does not admit of question, far less of assumption that it is settled. To conclude, it is the fact, that a telegraph cable which passes in one place through a depth of 1,500 fathoms has been for a year, and is now in successful operation. I refer to the Malta and Alexandria line. Had "H. K.'s" theory of superincumbent pressure been capable of accounting for the failure of other lines, no such success could ever exist. The pressure, whether in the test-tank or the ocean, invariably has improved the insulation by the consolidation of the material, and such pressure is rather to be courted than feared. "H. K." supposes that, in the bottle experiment, the water presses through the glass; not a bit of it. The water pressure forces the cork in—fills the bottom with salt water—and very often gives evidence that it has done so by replacing the cork, with the sealed side *down*, in the neck of the bottle. And, if gutta percha or india rubber contained air-cells like wood, they too would be water-logged, as the wood invariably is by the deep sea pressure.

There is no insuperable difficulty in laying or preserving deep sea telegraph cables on the generally tranquil bed of the ocean, if seamen's knowledge be made use of in the operation; and if the solution of maritime problems be left to those whose life has been past in the acquirement of maritime skill, we shall hear no more of the disgraceful failures which have so long checked the progress of international communication, and hindered the development of submarine telegraphic enterprize.

I am, &c.,

J. H. Selwyn.

[We consider that this controversy has occupied sufficient space in our columns, and must decline inserting any more letters on it at present.—Ed. M. M.]

Miscellanea.

A transport vessel on a new plan has just been completed at Cherbourg, France. Thirty-six others are nearly finished on the same plan, and they are to be increased to 50. Each vessel is capable of accommodating 1,000 men, so that in case of necessity the flotilla at Cherbourg might transport an army of 50,000 men.

Dr. Riederhoff, says *Galignani*, has successfully administered fatty substances as an antidote to strychnine. From experiments instituted on about 30 dogs and rabbits, it appears that the absorption of strychnine and its compounds is prevented by administering fat, butter, or oil, the first being more active. Time is thus gained to proceed to other remedies, such as emetics; but as any fatty substance also impedes the action of the latter, they must be given in larger doses, or else the stomach-pump should be used. At all events, fat seems to be more efficacious than other antidotes in the case of poisoning by strychnine, especially more so than morphine, conicine, or aconitine.

The Cambria Iron Company (Pittsburgh, U.S.) have just turned out of their foundry the rim of the fly-wheel for their new rolling mill. It is cast in one piece, and is 20 ft. in diameter, and weighs 23 tons. Larger castings of this character are seldom made. The engine for which this wheel is intended is on the ground, and being rapidly put into place. From the size of the fly-wheel some idea can be formed of the power of the engine.

A New Material for Ceramic Manufactures.—Dr. Muspratt, Principal of the Liverpool College of Chemistry, is of opinion, from an analysis he has made of a sample of phosphate of lime from Estremadura, the almost inexhaustible supplies of which have lately been made available by the concession of the right of working the quarries to Mr. F. K. Dumas, of London, that it is admirably adapted, on account of its purity, for the manufacture of porcelain and Parian. It contains 93 per cent. of phosphate of lime, nearly 4 per cent. of silica, a little phosphate of magnesia, and a trace of carbonate of lime. The phosphate worked at the island of Sambrero, of which Mr. Dumas is the consignee, is of analogous composition to that of Estremadura.

Watchmaking by Machinery in America.—In Waltham, Massachusetts, there is a watch manufactory which employs nearly 500 artizans, and turns out 50,000 watches annually. All the works of the watches are made by machinery. One pound of wire, worth a guinea, is converted into 100,000 watch screws worth £700. The jewels are perforated by a drill which is as fine as a spider's web, and the perforations are measured by gauges that indicate the ten-thousandth part of an inch. If a Waltham watch gets out of order anywhere in America, any part of the works can be obtained, exactly suitable, by sending the number of the watch to the manufactory.

A Novel Launch of a Steamer.—Traction Engine Trail.—A screw steamer which was built at Messrs. Davidson and Wood's yard, North-street, was on Wednesday evening and yesterday morning, conveyed to the river by means of a traction engine. The vessel is 95 ft. long, with 19 ft. breadth of beam, 8½ ft. in depth, 150 tons register, and weighed with the truck on which it was carried about 45 tons. It was brought to the foot of the steep hill in North-street, immediately below St. Vincent-street, by means of blocks and other tackle, by hand labour, during the day. The engine which has just been completed by Messrs. Alexander Chaplin and Co., for Bray's Traction Engine Company, London, possesses the advantages of both Bray's and Chaplin's patented improvements. It has a pair of cylinders seven in. diameter, with three sets of spur gearing (made of Messrs. M'Haffie and Forsyth's improved malleable cast-iron) to the wheels, for speeds of two, four, and eight miles an hour respectively. It arrived at the vessel about half-past eight o'clock on Wednesdey evening, and the tackle being made fast, the vessel was easily drawn up the incline by means of a pair of blocks. The vessel after reaching St. Vincent-street, was then swung round and the engine connected. It towed it along St. Vincent-street to the head of Finnieston-street, where the engine had to be disconnected again to allow the vessel to be brought round the corner. Yesterday morning early the engine again got steam up and was connected, when the vessel was taken down to a large crane at Finnieston Quay and lowered into the water. Her machinery of 25-horse power, will be supplied by Messrs. Smith, Garscube-road. She has been named the "Wingfield," and is intended to ply between Glasgow and the Highlands, *via* the Crinan Canal.—*North British Mail.*

A New Locomotive.—On Monday last, says the *Devizes Gazette*, we had the pleasure of witnessing the trial trip of a new traction engine which has just been turned out of the North Wilts Foundry, and which seems to us to come nearer to what is really wanted than anything we have before seen. This engine, which is simple in construction and moderate in cost, is intended to accomplish two objects. While it will draw heavy loads at a slow pace or lighter ones at the rate of 8 miles an hour, it is applicable to general agricultural purposes. In other words, it will plough and thrash all the week, and bring the corn to market if required, and that at a cost which no horses could ever attempt to compete with. On Monday it started from the Foundry along the London-road, drawing behind it 14 tons, besides its own weight of 8 tons. For instance, it had behind it a portable engine weighing 3 tons, and two carriages weighing half a ton each, containing 10 tons of rough pig iron; and with this weight (of 22 tons altogether) it ran along the road, and up the Bishop's Cannings-hill, which has a gradient averaging 1 in 16, with all the ease imaginable. Indeed, we believe it would have carried half as much again behind it. But what was most observable was the perfect control under which it appeared to be; it was turned round the sharp corner leading into Bishop's Cannings village, and again into the Horton-road, without the slightest difficulty, and was pulled up, at the instant and on the spot, several times during the journey, in order to avoid the chance of accident to the vehicles that were met on the road. The traction engine was made by Brown and May, of Devizes.

The Source of the Nile.—The telegraphic announcement of the discovery of the source of the Nile, made a few days ago, has been followed by the publication of a summarized narrative, prepared from the papers of Captain Speke and Captain Grant. The narrative was laid before the members of the Royal Geographical Society by Sir Roderick Murchison, on Monday, and it embodies a vast amount of interesting information. The explorers are expected to arrive in England during the first week in June, and in the meantime the public will read with pleasure the record of their labours and of their success.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2907, 2921.
Boilers and Furnaces, 2908. 2925, 2926.
Ships and Boats, including their fittings, 2932, 2940.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2924, 2944.
Cultivation of the Soil, including agricultural implements and machines, 2920.
Food and Beverages, including apparatus for preparing food for men and animals, 2927.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2900, 2901, 2914, 2918, 2922, 2928, 2934, 2936.
Buildings and Building Materials, 2933.
Lighting, Heating, and Ventilating, 2905, 2915, 2929, 2938.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2902, 2911, 2916, 2917, 2923, 2935, 2939, 2941, 2942, 2946.
Metals, including apparatus for their manufacture, 2899, 2903, 2904, 2909, 2913, 2930.
Chemistry and Photography, 2906, 2937.
Electrical Apparatus—*none.*
Warfare, 2910, 2931, 2945.
Letter-Press Printing—*none.*
Miscellaneous, 2912, 2919, 2943.

2899. J. Fletcher and J. Fletcher, jun. *Improvements in machinery for shaping iron and other metals.* Dated October 28, 1862.

This invention relates more particularly, but not exclusively, to machinery for producing the spokes of iron wheels, bolts, and such like articles, having several diameters and variations in section or form, in order that they may be produced uniformly and rapidly from bars of square, hexagonal, octagonal, or other shape. In making bolts, in order to reduce the bar to the required diameter, the inventors pass the bar through rollers having grooves alternately oval and round, so that, after passing through the one, the bar is turned half round and passed through the next. Bolts, with hemispherical heads and partly square body, are rolled from a square bar of the same size as the square part of the bolt, and the head is formed in a heading machine. Bolts, having square, hexagonal, or octagonal heads, and a partly square body, are rolled from square, hexagonal, or octagonal bars, and are first passed through suitable grooves to form the square part of the bolt, and afterwards through an oval and a round groove to form the round part or the part of smallest section. The bar to be treated, say, for the purpose of making bolts, may be of the same form and size as the head of the finished bolt; it is reduced, whilst hot, between rollers having suitable grooves therein, and by means of a reciprocating movement backward and forward, instead of an entire revolution, the point of the bolt is reduced, and the length or extent required between the point and the shoulder is regulated by means of adjustable stops or gauges in each groove within the limits of stroke or partial revolution. For making plain round bolts, with hexagonal or other shaped heads, the larger diameter may be cut by means of a saw sufficiently long to allow for the height or depth of the head; the pieces then may be placed in the dies of a heading machine, where the corners of the head are rounded off and the head squared down, so as to form a shoulder at right angles to the axis of the bolt. The rolls of the machine in which the reduction is effected have part of the circumference of each grooved to the requisite size and form for the smallest part of the bolt, and also with a recess or larger grooving to allow of the introduced part of the bar to go forward up to or beyond the centre line of the rolls without being acted upon. By this means the reduction of diameter is carried up to a square shoulder. The diametrically opposite parts of each of the rolls should be made similar, so that when one part is worn out the rolls may be shifted round and the opposite side used. The pair of rolls are made alike, so that the two small grooves are opposed to each other during the partial rotation. *Patent abandoned.*

2900. E. and A. Tatham. *An improvement in warp machines for the manufacture of looped fabrics.* Dated October 28, 1862.

This invention consists in the employment of metal bars or levers, as described, instead of strings, for dividing and pushing aside the spring guides in warp machines as required according to the pattern to be performed. The levers are free to play upon fixed points, and have motion communicated to them from the jacquard through strings connected to the long arms of the levers. *Patent completed.*

2901. H. Allen. *Improved apparatus for preparing leaves and stalks of plants for being cleaned or dressed for the purpose of obtaining the useful fibres they contain.* Dated October 28, 1862.

This invention relates to mechanism for dividing up in a longitudinal direction, leaves or stalks which have thick butt ends, the object of the invention being to reduce the leaves or stalks to such a state that they may be cleaned or dressed without the risk of the useful fibres they contain being tangled or matted up in the operation. To this end the inventor passes the leaves or stalks longitudinally under the knives or cutting instruments, whereby they are sliced into narrow strips, which may be easily operated upon by the cleaning or dressing machine. The apparatus consists of a table on which the leaves or stalks are placed, and on which they are moved or drawn forwards by two nipping rollers, while a series of knives or cutting instruments secured in a bar are brought down thereon. A convenient mode of working this bar is to mount it on a hinge or centre pin at one end, and connect the other to a treadle lever, whereby it may be brought down when required by the foot of the attendant. The principal feature of novelty in this invention, however, consists in subdividing the leaves or stalks into narrow strips by means of suitable cutting instruments. *Patent abandoned.*

2902. G. H. Smith. *Improvements in the manufacture of crinoline or elastic hoops for dresses.* Dated October 28, 1862.

This invention consists in combining metallic and fibrous strands together for the purpose of forming an elastic fabric suitable for making elastic hoops for dresses. In carrying out this invention, the metallic and fibrous strands are arranged side by side in the form of a warp, and are woven into a fabric of the desired width by the introduction of ordinary weft threads. *Patent abandoned.*

2903. E. S. Tudor. *Improvements in the purification of lead.* Dated October 28, 1862.

This invention consists in subjecting the lead melted in a furnace, pot, crucible, or any other suitable vessel or apparatus, to the action of litharge or other oxide of lead in a state of fusion or semi-fusion. *Patent completed.*

2904. C. S. Duncan. *An improved compound or material for coating or covering metallic and vegetable substances to preserve them from corrosion or decay.* Dated October 28, 1862.

In carrying out this invention, the patentee proposes to use marine glue, gutta percha, india rubber, shellac, copal, mastic, vegetable, or mineral pitch, tar, resin, iodine, sulphur, creosote, or asphalte, bitumen, and coal tar, in combination with one or more of the following substances—alumina, schist, quartz, slate, silex or flint, marble or pozzolano, sand, sandstone, cement (natural or artificial), chalk, glass, emery, tripoli, white oxide of zinc or of lead, or the litharge or red oxide of lead, in every case reduced to a fine and nearly impalpable powder, in proportions varying from one-fourth part to five parts of these powdered materials to one part or more of the before-mentioned plastic substances. The materials are then to be heated, so as to reduce them to a plastic or semi-liquid state, and he also heats the metal or metals to be coated with the compound to a moderate temperature, and while in this heated state he lays on the coating with brushes, or by any convenient method. Immediately after the coating has been laid on the metal, wood, or other body to be preserved, and before it is allowed to cool, the compound is to be covered with a layer of one or more of these mineral powders before-mentioned in a warm state, in order to entirely remove all stickiness or tack. When the compound has become cool, the surface may be brought to a smooth or polished exterior by rubbing it with any ordinary substance used for rubbing down or polishing mineral or metallic surfaces. *Patent completed.*

2905. J. Jeffreys. *Improvements in constructing surface condensers and apparatus for heating and cooling fluids.* Dated October 28, 1862.

In constructing surface condensers of steam engines, the inventor employs thin plates of copper or other metal, which he presses or stamps with numerous parallel flutes, separated the one from the other by flat ridges. These plates are then placed together in pairs, face to face, so that the ridges of one plate come truly over those of the other; but they are separated by a soldering or brazing metal placed between the two. The pairs of fluted plates thus arranged are piled up one pile over the other, but with suitably fluted plates of iron between the pairs, so as to make a solid pile, which is then placed under pressure to bring the ridges of the two plates of each pair close up the one to the other. In this state the pile is heated till the soldering or brazing metal melts, when the pile still under pressure, or placed if necessary under increased pressure in a press, is allowed to cool. In this manner a perfect union of the ridges is obtained, each pair of plates becoming a set of tubes. These sets of tubes may be connected together by turning up the edges of the plates of which they are formed, and enclosing them in a split tube, into which cement or solder is then cast or soldered; or brazed joints may be employed. The whole arrangement is enclosed in a case, and the steam to be condensed is caused to pass into the tubular spaces, whilst the cooling or condensing water is made to circulate in the spaces between the pairs of plates. *Patent abandoned.*

2906. T. Sutton. *Improvements in preparing albumenized paper for photographic purposes.* Dated October 28, 1862.

It is, according to this invention, proposed to prepare the paper before albumenizing it by soaking it in a solution of india rubber, gutta percha, benzole, or any of the other suitable solvents of these substances; for example, chloroform, kerosolene, or bisulphide of carbon. A very good solution for the purpose consists of five grains of india rubber dissolved in one ounce of benzole. After the paper has been immersed in this solution and dried, it is to be albumenized in the usual manner. *Patent completed.*

2907. A. Ripley. *Improvements in the construction of pistons for steam engines, which improvements are also applicable to air and liquid pumps.* Dated October 29, 1862.

This invention consists in certain improvements in the construction of the said pistons, and the object of the invention is the production of a piston which shall permanently possess a self-maintaining steam-tight expanding metal packing, the expansion being constantly maintained by the pressure of the steam, air, or other fluid itself. *Patent completed.*

2908. A. Shanks and F. Kohn. *Improvements in hydrostatic presses.* Dated October 29, 1862.

This invention consists in making a hydrostatic press worked by steam power, in such manner as to exert the direct pressure of the steam upon the water in the main cylinder of the press, by opening a free communication between this cylinder and the boiler, and moving the ram by this direct pressure until the resistance of the object operated upon be equal to this pressure, at which moment steam is admitted under a large piston operating on a ram of smaller diameter in communication with the main arm, so that the motion of the lesser ram produces on the larger one an increased pressure in the ratio of their respective areas. *Patent completed.*

2909. G. Darlington. *Improvements in the manufacture of zinc oxide.* Dated October 29, 1862.

This invention consists in the production of zinc oxide by the use of a smokeless carbonaceous fuel, acting upon a zinc ore in an open furnace, so as to form oxide of zinc, which, passing out of the furnace, is conducted to the collecting apparatus where it is deposited. A coarsely ground mixture of the ores of carbonate or silicate of zinc (with or without flux) and anthracite coal or other smokeless fuel, is placed in a furnace opening into passages leading to a collecting apparatus, and subjected to heat produced by the combustion of similar smokeless coal or fuel. The mixture may be placed in a separate chamber of a furnace, and adequate heat derived from anthracite or other smokeless fuel made to pervade the entire mass; or it may be mixed with such heating material, and in either case the zinc oxide is extracted or separated from the ore and deposited in the collecting apparatus. *Patent completed.*

2910. A. Krupp. *Certain improvements in breech loading firearms.* Dated October 29, 1862.

This invention consists in opening and closing the breech of ordnance and other firearms by means of a sliding valve, or wedge piece, moving at a right angle or other angle to the axis of the bore of the gun. This wedge piece, or sliding valve, works horizontally, and may be provided or combined with various arrangements for the purposes of more effectually preventing the escape of gas at the breech when the piece or arm is discharged, and of simplifying manipulation. *Patent completed.*

2911. A. Hogg. *Improvements in smoothing irons.* Dated October 29, 1862.

In one modification of this invention, the body of the iron is in the form of a hollow box of a square shape in cross section, and pointed at one or both ends. The box is formed with two ironing faces, and the other two sides are perforated or open. Through the centre of the box there is passed a pipe, which is pierced with minute holes for gas jets, and gas being admitted to this central jet pipe by means of a flexible or jointed tube, the jets are ignited, and heat the side of the box which for the time being is uppermost. Openings may be provided to admit air to admix with the gas before ignition, as in what is known as the "Bunsen" burner. When the top side is sufficiently heated for use it is turned down, and the side which was downwards before is in its turn heated by the gas jets in readiness for use by the time the other side becomes cooled. To permit of the iron being turned in this way, it is connected to the handle bow so as to turn about its axis in the bow, whilst a pin inserted through a hole in the bow into either of two holes in the iron or box serves to fit it in either position. The central gas jet pipe is fixed to the bow, so that it keeps its position notwithstanding the turning of the iron or box. One of the perforated sides is made removable, so that the interior may be cleaned. *Patent abandoned.*

2912. W. Clark. *Improvements in apparatus for ascertaining and recording the speed and distance travelled by vehicles, the flow and quantity of water, and other analogous purposes.* (A communication.) Dated October 29, 1862.

The principal features of novelty on which the present invention is based are as follows:—1, A band of paper of suitable width, and of a ctrtain length, without any previous preparation, is wound on a reel or bobbin, and is replaced by another when used up. This paper strip receives the various accidental marks or chronometric points, the nature of which is determined according to that of the operation to be controlled. This band is divided and pointed by the instrument itself, so that the divisions of time shall be indicated by groups and details clearly and visibly, by means of a pointer which cannot err with regard to the fidelity of its indications. 2, Two cylinders are suitably disposed, and carry a band with them in their chronometric motion, which strip is graduated to an extent according to the purpose for which it is required, and divided into fractions of hours, or by measures according to each impulse imparted by means of points projecting on one of the cylinders, and taking into the other one in the manner of toothed gearing. 3. A series of piercers of various forms, indicative of the nature of the operation, are caused to pierce the band at the divisions without arresting its progress at the moment where the controlling action is accomplished: that is to say, at its commencement and termination, according to the order previously determined by the nature of the operation. The parts for actuating the apparatus are appropriate to each kind of operation, and they are both regular and accidental in their action. *Patent completed.*

2913. W. Clark. *Improvements in the treatment of copper ores and in apparatus for the same.* (A communication.) Dated October 29, 1862.

The patentee claims—1, The method of extracting metallic copper direct from any kind of matt, by the simple action of air projected on the matt while at a red heat, or by injecting air into the matt in a state of fusion, and apparatus applied as described. 2, Refining all kinds of copper while in an impure state by the injection of air into the interior of the metallic bath; also by the admission of steam into the said bath, and intimately mixing charcoal or coke in powder therewith. 3, The method of extracting metallic copper from ores containing copper pyrites, and from grey copper ores, by treating the said ores in a blast furnace with carbon, and with the action of air injected as in ordinary blast furnaces, or with steam injected, all as described. *Patent completed.*

2914. J. W. Lister, A. Bottomley, and W. Bottomley. *Improvements in looms for weaving.* Dated October 29, 1862.

This invention relates to the letting-off and taking-up motions. The inventors propose to have for the letting-off motion a warp beam as usual, and instead of applying the friction to the warp beam, they employ three or more rollers, which take the warp from the warp beam, and the friction is applied to one or more of these rollers. The taking-up motion they propose to make as follows:—The cloth comes over the cloth beam in the usual way, when it is taken hold of by three or more rollers (geared and pressed together, and driven from some convenient part of the loom) which take the cloth as it is woven and wind it on the cloth roller. *Patent abandoned.*

2915. W. Cooke. *Improvements in apparatus for ventilating.* Dated October 29, 1862.

One portion of these improvements consists in constructing ventilators formed of wire-gauze or other material, perforated or otherwise, so as to fit any window or such like opening, the same principle being also applicable to window cornices, poles, and the ordinary dwarf wire gauze blinds for the purposes of ventilation or otherwise. Another portion of the improvements relates to the fastening of such ventilators, blinds, cornices, or poles, by means of a fastening attached to the window frame or beading, of a socket or other required shape. Another portion of the invention relates to improvements by which ventilators are constructed of wire gauze, or other perforated material, of two or more folds or slabs at an angle to each other, and which may be made stationary or to expand or contract at pleasure. Another of the improvements consists in the means of elongating the ventilators, window cornices, blinds, or poles by the means of a peculiar arrangement of the ends of such ventilators, by which they may be extended or contracted at pleasure. And another improvement consists in the application of wire gauze, or other perforated material, to the top and the bottom of a window or other such like opening, in such manner that, by the means of a cord or other suitable arrangement, they may be made to act and work simultaneously or otherwise, so as to permit ventilation at both top and bottom of the window or opening to which they are affixed. *Patent abandoned.*

2916. W. E. Evans. *Improvements in apparatus for playing organs, harmoniums, pianos, and other similar keyed instruments and also improvements in reed musical instruments.* Dated October 29, 1862.

In chamber organs, harmoniums, pianos, and similar instruments, it is very inconvenient to arrange pedal keys, as is usual in large organs, in consequence of the space they occupy, and the additional room that is required under the key board to give freedom for the movement of the legs, as is required in pedaling. According to this invention, to obviate these inconveniences, the inventor constructs an apparatus which can be applied to an ordinary chamber organ, harmonium, piano, or other similar keyed instrument, when it is desired to play it by means of pedal keys in conjunction with finger keys. This apparatus consists of finger key board or finger key boards, and pedals underneath, coupled therewith; each finger key is made when depressed to give motion to a lever, the end of which, when the apparatus is in its place for playing the instrument, stands over the corresponding key of the ordinary finger key board of the instrument to be played, so that, when a finger key of the playing apparatus is depressed, the corresponding key of the instrument itself is struck by the lever, and the instrument is caused to sound, the pedal keys (as before mentioned) being coupled with the finger keys thereof act in a similar manner. The playing apparatus, when not required for use, being separate from the instrument, can be moved away therefrom. *Patent abandoned.*

2917. W. E. Gedge. *Improved apparatus in connection with the pans of water-closets.* (A communication.) Dated October 29, 1862.

In carrying out this invention, the inventor proposes to fit on to the shaft of the trap of the pan a crank connected by a rod with a lever, one end of which is furnished with a counter weight to close the trap when the foot is removed from the pedal, and the other covered by a pedal of thin metal screwed to the flooring, in order that it may not catch in or tear the clothes; on this the foot is placed to bring the trap into action. For double-action pans, a cock is seated on the shaft of the trap, so that it and the trap open at the same moment. *Patent abandoned.*

2918. W. E. Gedge. *Improvements in looms for weaving.* (A communication.) Dated October 29, 1862.

This invention consists in a continuous shuttle box and an endless chain with eccentrics. The system of continuous shuttle boxes consists in employing as many shuttles as there are different colours to be used in the manufacture of a fabric, a cylindrical box turning each time that the colour of the shoots must vary, this movement being produced by means of a counter or meter, which is regulated beforehand, according to the pattern of the fabric. The object of the chain with the eccentrics is to make simultaneously all sorts of fabrics as promptly as glossy or glazed stuffs. *Patent completed.*

2919. D. Fryer and J. W. Meears. *Improvements in casks, tanks, or other receptacles for containing petroleum or other oils or spirits.* Dated October 29, 1862.

This invention consists in the application of a moveable lining to the interior of the cask, tank, or other receptacle for containing the above class of liquids, the object being to prevent the contact of the oil or spirit with the cask or receptacle itself, and to obviate the consequent impregation, as well as to prevent loss by leakage. The lining is to be made of vulcanized india rubber. *Patent abandoned.*

2920. J. Head. *Improvements in machinery employed when cultivating land by steam power.* Dated October 29, 1862.

In order that steam cultivation may be continued when too dark to see to steer the cultivating implements, the inventor applies apparatus to the implements and machinery for carrying lamps, and provides for telegraphy by means of lights between the engines, the cultivating implements, and the anchoring apparatus. This he prefers to accomplish by means of four lamps, three of them for signals, and the fourth, a large bull's-eye lamp, concentrating its light in one direction. *Patent abandoned.*

2921. J. Unsworth. *Improvements in steam engines.* Dated October 29, 1862.

This invention relates to certain modifications and combinations of the valves, cylinders, and ports of steam engines, with a view to avoiding compression or back pressure in the main cylinder. For this purpose, according to one arrangement, the pipes or passages employed to convey the steam to two small cylinders alternately are placed close to each end of the main cylinder, and additional ports, which are to prevent back pressure or compression, are placed within about 2¼ in. of each end of this cylinder, so that, when the piston reaches the end of the cylinder, it covers the port which has been opened to prevent back pressure; but so soon as steam is admitted into the large cylinder, it moves the piston valve in the small cylinders, and closes the port upon which the main piston is standing, opening at the same time a port at the opposite end of the main cylinder. This is performed whilst the crank is travelling over the centre. The steam admitted into the small cylinder returns as soon as the exhaust port is opened to the large cylinder. This arrangement prevents any escape of steam. If preferred, the steam may be admitted into the small cylinder or cylinders direct from the boiler. In this arrangement the small cylinders are situate opposite, or nearly opposite, to each other. The entire apparatus is fitted on to a metal plate, the length of which must be in accordance with the engine cylinder upon which it is bolted, the communication from the large cylinder to the small ones being through this plate. *Patent completed.*

2922. F. L. STOTT. *Improvements applicable to mechanism or apparatus for warping yarns or threads.* Dated October 29, 1862.

This invention relates to warping machinery known as warping mills, and to that part termed the "heck," and refers, in the first place, to a modification of the common eye-heck having an eye for each thread, and consists in curving the bars in which the eyes of the heck are secured, and in turning each eye to such a position that the axis of the hole forming the eye will be in a radial line drawn from the centre of the radius to which the heck is curved, so that the line of the axis of each eye will agree as near as practicable with the direction of a horizontal line drawn from the bobbin in the creel or form, a point vertically above or below the bobbin to the eye in the heck. The improvement also consists in curving beer hecks, which are placed between the eye-hecks and the pot-rollers to correspond with the curvature of the eye-heck. *Patent completed.*

2923. A. P. F. NEWHAM. *Improvements in the manufacture or production of reversible shawls.* Dated October 29, 1862.

For the purposes of this invention, the inventor manufactures or produces an improved shawl, in which one, two, or more falls, lappets, turnovers, flaps, or pieces are combined with the body or main piece of the shawl, over each side or surface of which the said falls, lappets, turnovers, or flaps can be turned at pleasure from the top of the shawl, each one as turned over modifying or altering the appearance or design of the shawl, and by having the main piece of the falls, lappets, turnovers, flaps, or pieces presentable on both sides, the appearance or design of the shawl may, by reversing it, be further varied, according to the side presented to view. *Patent abandoned.*

2924. J. FLETCHER and J. FLETCHER, jun. *Improvements in forming wrought-iron wheels, and in the tools for making the same.* Dated October 29, 1862.

In forming wrought-iron wheels according to this invention, the inventors make each spoke-piece of such a length that, by bending it over to form part or portion of the circumference of the wheel frame, and thinning and bending the point over, when the several pieces are assembled, the extreme end of one bent spoke piece is brought in contact with the back of the rounded corner or outside angle of the next bent spoke piece; the curved space left between them is closed or made good by an angular filling piece, the requisite number of which being inserted round the wheel frame, they are then welded up and so make the ring complete. The inner ends of each of these spokes are brought together to form the boss, and wedge pieces are introduced between them. On one face of the wedge piece a groove is formed; there is also a corresponding groove on the inner edge of the spoke, so that, when the pieces are brought together, these grooves form a square or round rivet hole. On each side of the boss a washer is laid, and, having holes corresponding to those made through the boss, rivets are inserted, and the two washers and the boss are securely riveted together, and afterwards welded and forged. *Patent abandoned.*

2925. J. LOCKWOOD. *Improvements in boilers.* Dated October 30, 1862.

This invention consists in placing fire-clay or metal of cylindrical or other suitable form behind the bridge in the flues of Cornish or other boilers, which reduce the area so as to cause the flames to circulate or pass on all sides thereof, and impinge more keenly on the heating surfaces, whereby steam will be generated more rapidly, and fuel economized, and the great heat imparted to the fire-clay or metal will ignite the combustible gases as they pass from the furnace, and thereby prevent or consume the smoke. *Patent abandoned.*

2926. H. EASTWOOD. *Improvements in boilers and furnaces.* Dated October 30, 1862.

This invention consists in constructing tubular boilers with furnaces having hollow grate bars and down draught, and ordinary furnaces underneath, as described. *Patent completed.*

2927. F. GREGORY. *Improvements in presses for pressing seeds, fruits, hops, and other substances.* Dated October 30, 1862.

The cross-head of the press is, according to this invention, supported by two or more columns in the usual manner. Instead of turning the screw for the purpose of moving the ram or platen up and down, the patentee causes the nut to revolve, so that the screw moves up and down without turning. On the nut he fixes or casts a bevel wheel on a driving shaft, and likewise on the nut he fixes or casts a worm wheel, and gears it into an endless screw or worm on another shaft. When the pressure is required, he gives a slow motion to the nut by turning the worm geared into the worm wheel, and when the screw ram or platen are to be moved to or from the material, he puts the worm out of gear with the worm wheel, and causes the nut to be turned more quickly by turning the bevel wheel geared into the bevel wheel at the end of the nut. *Patent completed.*

2928. G. MAYALL and J. HOLLINGSWORTH. *Certain improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.* Dated October 30, 1862.

This invention relates to improvements in apparatus for steaming and damping cotton or other fibrous materials whilst being prepared to be spun, such process forming a portion of the said preparation. The apparatus is to be applied to such machines as are employed to open the cotton, and consists in a perforated chamber supplied with steam, and situated or placed beneath the endless travelling cloth or "delivery lattice," which is employed to convey the fibrous material from the machine. The steam ascends from the perforated chamber through the interstices of the lattice, and permeates the fibrous material as required, the diffusion of the steam being prevented by means of a cover above the cotton terminating in a channel or flue to convey the steam away. The amount of saturation is governed by the quantity of steam admitted to the chamber, such supply being regulated by a tap. *Patent completed.*

2929. J. EATON. *An improvement or improvements in the manufacture of certain kinds of gas burners for illuminating purposes.* Dated October 30, 1862.

In making gas burners according to this invention, the inventor bends a piece of iron tubing into the form of a ring, and joins the ends together by brazing. The said ring is supported by the pipe conveying the gas, which pipe is brazed to the ring either at the point where the ends of the tube are joined or at any other part. On the upper side of the tubular ring, holes of the requisite size are drilled for the passage of the gas. The small iron tubing he employs may either be of a cylindrical figure, or flattened. *Patent abandoned.*

2930. G. PIGGOT. *New or improved machinery for punching, shearing, and riveting sheets or plates of iron and other metals and alloys.* Dated October 30, 1862.

This invention consists, under one head, of a punching machine for punching rivet holes, or holes for other purposes, in sheets or plates of iron and other metals or alloys. The said machine punches a plate on its two opposite edges or sides, and afterwards, without refixing the plate, punches the ends or sides of the rails at right angles with those first punched. By means of a differential dividing apparatus, which forms part of the machine, the distance between the holes punched may be varied with great nicety. It also may be made to punch plates with any given camber. The invention consists, secondly, of a shearing machine constructed to shear one side and one end of a metallic plate, either at the same time, or at two separate cuts. The invention consists, thirdly, of a machine for riveting together sheets or plates curved to the segment of a circle, the riveting being so effected that the axis of the said rivets are in the direction of radii to the curve of the jointed plates. The machine is also adapted to rivet plain plates. *Patent completed.*

2931. P. GIFFORD. *Improvements in air guns and leather air arms.* Dated October 30, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2932. J. HORTON. *Improvements in the construction of armour-plated ships and fortifications.* Dated October 30, 1862.

In constructing armour-plated ships according to this invention, the inventor forms the ship with hollow ribs or frames, as has before been proposed in the specification of a patent granted to Alexander Samuelson, and dated February 12, 1862 (No. 373), but in place of applying thereto armour plates having flanges, which are butted together and lodged within the hollow ribs or frames, as is there proposed, the present inventor employs armour plates having no flanges, but which are recessed at their edges. These plates are held in their places by T-pieces, the head of each T-piece lapping over the edges of two adjoining plates, and fitting the recesses so as to make a flush surface, the stems of the T-pieces enter and are secured within the hollow ribs or frames. The ends of the armour plates are arranged so as not to come directly one under the other, but the joints are distributed as uniformly as possible over the whole of the ribs or frames, and the hollow ribs or frames, where they are not required to receive T-pieces, are closed in by the ordinary skin of the vessel under the armour plate. In order to prevent the ends of the armour plates from drawing out from their fastenings, he forms the bottom of the recesses at the ends of the plates with grooves, and he makes the heads of the T-pieces with corresponding projections to lock into these grooves. *Patent abandoned.*

2933. J. BIRCH. *Improved apparatus for unstopping or clearing from obstructions drains, water-closets, stack water, and other pipes.* Dated October 30, 1862.

This invention consists of a series of tools or implements of different kinds, which are capable of being adapted to the end of a jointed or other rod, so that they may be introduced into the pipe or tube for the purpose of removing any obstruction that may be found therein. In order to enable the jointed rod to be passed with facility by any projecting part of the tube, two or more anti-friction rollers are mounted on a swivel cross-head or horizontal swivel pin, so that they may rotate thereon in either direction. *Patent abandoned.*

2934. A. GUILD. *Improved apparatns for preparing and treating the leaves and stalks of fibre-yielding plants, and for cleaning and dressing the same.* Dated October 30, 1862.

The first of these improvements relates to a mode of preparing for the subsequent processes of cleaning or dressing such leaves or stalks as are too large or tough to be advantageously operated upon in the dressing or cleaning machine without some previous preparation. The object of this part of the invention is so to prepare the leaves and stalks that they can be the more readily acted upon by any machine for extracting the useful fibres. The machine whereby this object is effected consists of one or more pairs of rollers, between or under which the stalks or leaves are to be fed, and brought under the operation of an adjustable bar, armed with wedges or knives, whereby the leaves or stalks are split or disintegrated lengthways. This bar, which the patentee calls the "splitter," is capable of being pressed more or less on the leaves or stalks by the foot or hand of the operator. By this arrangement of parts, the operation of the knives or wedges may be modified or stopped at the will of the operator, as immediately pressure is taken off the treadle, whereby the splitter is depressed, the latter will be lifted up by the force of a spring, or by a counterbalance weight. Another form of apparatus, and which is perhaps the more preferable form, consists of one or more rollers with wedge-shaped grooves or corrugations at right angles to their axis, so that, by causing the salient edges of these wedge-shaped corrugations to press on the leaves or stalks which are placed upon a table or travelling apron, the fibres may be separated or forced asunder, thereby splitting up and disintegrating the leaves or stalks, as above-mentioned, into strips of fibres, which may be afterwards cleaned in the machine which forms the second part of the invention. This machine cannot be descriped without reference to the drawings. *Patent completed.*

2935. G. HASELTINE. *Improvements in horse-shoe machines.* (A communication.) Dated October 30, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2936. W. ASTROP. *Improvements in the manufature of paper.* Dated October 31, 1862.

This invention consists in the employment of the fibrous portions of the roots, stems, and stalks of the beet, marigold, wurzell, chicory, and rhubarb plants for the manufacture of pulp for paper and cardboard, either separately or in combination with each other, or in combination with any of the pulps now ordinarily used for these purposes. *Patent abandoned.*

2937. W. R. BOWDITCH. *Improvements in carburetting or napthalizing gas and in the apparatus employed therein.* Dated October 31, 1862.

This invention consists in applying heat to vaporize and keep vaporous the hydro-carbons employed for carburetting or napthalizing gas for illumination, and in passing the gas before it is burnt through or over the heated hydro-carbons; also in the heating the hydro-carbons and keeping the volatile products hot by the gas flame itself, and in an improved apparatus to be used for the above purposes. The apparatus cannot be described without reference to the drawings. *Patent completed.*

2938. H. L. CORLETT. *Improvements in the construction of tuyeres.* Dated October 31, 1862.

This invention relates to an improvement in tuyeres of the kind known as "water tuyeres," for smiths' forge fires, cupolas, furnaces, and all purposes where air is introduced into fire to accelerate combustion, the water being, by means of this invention, forced to circulate in a continuous stream through the tuyere in obedience to the law, causing the heated particles of water to ascend to the surface or summit level of any body of water subjected to the action of heat. The circulation and continuous flow of the water prevents the deposit of any foreign matter in the water spaces of the tuyere, which is thus more effectually preserved from the action of the fire than has hitherto been the case. The tuyere, which may be connected in the ordinary manner with the water supply, is formed with an inner shell, constituting the usual air passage, between which inner shell and the outer shell is an annular water space, which is divided into two or more partitions, placed longitudinally, extending so far as in practice may be found desirable from the back in the direction of the front or nozzle end of the tuyere, a space or opening being left there to make a junction between the chambers formed in the annular water space of the tuyere by means of the partitions already described; or, if preferred, the partitions, or either of them, may be extended to the nozzle or front end of the tuyere; or the opening or passage connecting the lower with the upper chamber or chambers may be placed in any part of the partitions already described. *Patent completed.*

2939. G. DICKINSON and E. COOKE. *Improvements in the construction and ornamentation of metallic bedsteads, couches, and children's cots.* Dated October 31, 1862.

This invention consists—1, in constructing corner joints for metallic bedsteads, couches, and children's cots, in the following manner:—Upon that portion of the pillar at which the corner joint is to be made, the patentees make or fix a ring or annular shoulder, having on its edge a vertical rim extending partly round the said ring or shoulder. Above the said ring or shoulder the pillar is screwed, and a screw nut works on the said screwed part. That part of the joint connected to the sides of the bedstead or other frame consists of a flat bar of iron bent at right angles, the bent part of the bar being curved to a semi-cylindrical figure, so as to fit one half of the rod or pillar. This part of the joint is placed upon the pillar, the curved part being within the vertical rim on the shoulder, and the screw-nut is screwed upon the same part. It is thereby held down within the vertical rim and secured to the pillar. The invention consists—2, in ornamenting metallic bedsteads, couches, and children's cots in the following manner:—They take pieces of glass, either cut or moulded on one or both sides into a series of prisms, the said prisms being either convex or concave. They insert and fix pieces of glass of the kind described in the centre of the foot piece, or on other parts of the bedstead, couch, or cot to be ornamented. The figure of the pieces of glass employed gives great glitter or brilliancy to the bedstead, couch, or cot. *Patent completed.*

2940. D. SPINK. *Improvements in the method of propelling ships and other vessels.* Dated October 31, 1862.

This consists in a method of, and machinery for, propelling ships and other vessels by jets of hot air propelled by steam. *Patent completed.*

2941. A. ANDREWS. *An improved tool for cutting and rasping pegs in boots and shoes.* Dated October 31, 1862.

This tool consists of a flat shank provided at both ends with appliances for acting on the pegs which rise through the sole in boots and shoes. At one end of the shank, the appliance is in the form of a rasp at bottom with a cutting edge at top, so formed with ears or guards that, in using the tool, no cutting in the upper leather or lining can occur. At the opposite end, the appliance is in the form of a hollow figure with a cutting edge; this form of cutter also prevents any cutting of the lining or uppers in the use of the tool. Although the inventor prefers the shank to carry appliances, as above described, yet they may be similar at both ends, or the shank may carry one of the before-named appliances at one end only. *Patent completed.*

2942. C. BATHOE (late GUBBINS). *Improvements in irons for ironing.* Dated October 31, 1862.

The object of this invention is to prevent the possibility of singeing the articles being ironed; and the invention consists in dividing the box which contains the red-hot iron for heating the tool into compartments, the lower of which is to contain water or steam, and that above it the red-hot iron, while another compartment above the red-hot iron compartment may contain water, with a communication leading into the bottom compartment. Or the top compartment may contain the red-hot iron, the main feature in the invention being to prevent contact of the heating iron with the base of the tool which bears directly upon the article being ironed. *Patent completed.*

2943. G. H. MORGAN. *Improved mechanical arrangements for raising and lowering bodies.* Dated October 31, 1862.

This invention consists of a number of ladder frames, each being of less width than the other, so that the same may slide one within the other, each having at the lower part thereof a cross piece with a screw socket for taking the action of an upright screw shaft, to be worked by toothed-wheel gearing and pulley, with driving band and cranked handle, or equivalents for the same, by giving motion to which each ladder frame will successfully be lifted, so as to bring the lower end thereof to the top of the next one in which it slides, when it may be secured in position by means of a spring, catch, bolt, or pin, which will hold the same in its position until the whole series or the desired number of the series are thereby elevated, when, by the bodies to be raised being moved up the steps of the ladder frames, the same will be raised up; or they might be raised by being fixed on the top of the innermost ladder frame. Bodies will of course be lowered by a reverse action. *Patent abandoned.*

2944. H. THOMSON. *Improvements in railway signals.* Dated October 31, 1862.

According to this invention, the inventor proposes to place on the inside of the outer rail, both on the up and down lines, a bar or series of bars of iron, according to the length of bar to be acted upon, and to adjust the level of the bars so that the passage of a train or engine shall depress them by the action of the flanges of the wheels of the engine and carriages. He proposes to connect these bars with levers, rods, brackets, and springs, and with chains or wire ropes, so as to form a communication or connection with a hand signal by day, or with a lamp signal by night. *Patent abandoned.*

2945. M. C. C. SINIBALDI. *Improvements in the manufacture of armour plates for ships, fortifications, and forts, and in the manufacture of plates to be used in the construction and building of ships, and for attaching copper or other like protective metal to the outside of metal plates, for making copper bottoms or bottoms with a similar protection to iron ships, and for other purposes.* Dated October 31, 1862.

This method of constructing armour plates for building ships of war is to combine laminated plates of iron and steel, and also pieces of iron without steel, and steel without iron, perfectly wrought by soldering with copper, brass, or suitable metal, or alloys of metals. The invention cannot be fully described without reference to the drawings. *Patent completed.*

2946. G. SPEIGHT. *An improvement in the manufacture of collars for mens' wear.* Dated October 31, 1862.

For the purposes of this invention, the patentee forms the portion of the collar called the "band" of paper or cardboard, and he forms as a separate piece the portion called the "top" of paper or cardboard also. These two pieces he connects or unites by a "top" or piece of "linen," or other textile fabric, which covers the paper or cardboard "top" on the side which is outermost when the collar is in wear; a part of the said linen or other textile "top" also forms what may be called the joint, bend, or flexible portion between the two paper or cardboard portions (allowing the top to be turned down in turn-down collars, or to be set up in stand-up collars). Or the two paper or cardboard portions of the collar, that is to say, the paper or cardboard band and top, may be in one piece, the paper or cardboard top being covered with a top or piece of linen, or other textile fabric, on the side which is outermost when the collar is in wear. The top is thus formed of two materials, an inside and an outside portion, one of paper or cardboard, and the other of linen or other textile fabric; the latter is pasted or otherwise attached to the band at the nearest margin. He fixes or connects the piece or top of linen or other textile fabric to the paper or cardboard top, and he turns the edges or margins of such piece or top of linen or other textile fabric over the corresponding edges or margins of the paper or cardboard top, whereby a superior edge is obtained. By these means, the portion of the collar which, when in wear, requires, on account of the play of the neck or head, considerable flexibility, so as to yield without breaking (and which portion of the collar, when in wear, is exposed to view), will be of linen or textile fabric. He covers the parts at the ends and middle of the band, in which are the button holes, with tabs, patches, or pieces of linen, or other textile fabric. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Jan. 21, 1863.

192. H. Caro, chemist, and J. Dale, manufacturing chemist, Manchester. Improvements in obtaining colouring matters, part of which improvements is also applicable to dyeing and printing.

Dated Feb. 19, 1863.

451. R. P. Roberts, Kennington-oval. Improved axle boxes for carriages or vehicles. (A communication.)

Dated March 4, 1863.

603. J. F. Gits, Antwerp, manufacturer. An improved furnace for the revivification of animal charcoal.

Dated March 20, 1863.

751. J. Brigham and R. Bickerton, Berwick-upon-Tweed, implement makers. Improvements in reaping or mowing machines.

Dated March 23, 1863.

787. L. Christofleau, 60, Boulevart de Strasbourg, Paris, blacksmith. Improvements in firearms.

Dated April 14, 1863.

940. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in hardening and colouring gypseous limestone and sand and calcareous stones. (A communication.)

Dated April 16, 1863.

955. J. L. McLay, Liverpool, master mariner. Improvements applicable to mariners' compasses.

957. C. Terrett, Clifton-place, Stapleton-road, Bristol, saddler and harness maker. Improvements in preventing incrustation in steam boilers.

959. W. Oldfield, Noble-street, St. Luke's, writing and dressing-case manufacturer. Improvements in the construction of locks, applicable to despatch and other boxes, writing and dressing-cases, and other similar receptacles.

961. T. A. W. Clarke, Leicester, machine maker. An improved construction of shuttle driver, and apparatus for working the same.

Dated April 17, 1863.

963. R. Knight, Dunkirk, France, engineer. Improvements in treating and preparing iron, copper, and other wires for telegraphic and other uses, for the purpose of preserving them from corrosion or decay.

965. T. Richmond, manufacturer, and T. Richmond and D. Harling, machinists, Burnley, Lancaster. Certain improvements in looms for weaving.

967. R. C. Clapham, Walker, Northumberland, analytical chemist. Treating the waste liquors from bleaching powder stills in order to obtain hydrochloric acid and other products therefrom.

969. W. Massingham, Boston, Lincoln, brewer. Improvements in apptratus for cooling liquids.

971. B. J. Webber, Newton Abbott, Devon, engineer and agricultural implement manufacturer. Improvements in apparatus for separating corn from the ears, and for combing straw.

Dated April 18, 1863.

973. W. S. Macdonald, Manchester, practical chemist. Improvements in apparatus for drying animal, vegetable, and mineral substances.

975. W. B. Burden, Malvern. Improvements in wheels and axles applicable to locomotives, carriages, and paddle wheels.

977. T. Hunt, Banbury, Oxford, brewer. Improved apparatus for obtaining motive power.

Dated April 20, 1863.

979. C. Randolph and J. Elder, Glasgow, engineers. Improvements in surface condensers.

Dated April 21, 1863.

985. A. Ford, Stewart's-buildings, Battersea-fields, gentleman, and R. Rigg, 3, Great Winchester-street, City, gentleman. An improved method of re-forming and re-using old or waste vulcanized india rubber.

987. J. Heap, Ashton-under-Lyne, tool maker. Improvements in adjustable wrenches for nut pipes and pins.

991. J. W. Nottingham, Clayton-place, Kennington-road, artist. Improvements in two-wheeled vehicles.

993. H. Donald, Johnstone, Renfrew, engineer. Improvements in machinery or apparatus for bending or straightening metal plates.

995. W. C. Cambridge, Bristol, agricultural implement manufacturer. Improvements in the construction of harrows.

Dated April 22, 1863.

1001. T. Grace, Bristol, agricultural engineer. Improvements in reaping and mowing machines, part of which improvements is applicable to other useful purposes.

1003. E. J. Jeffs, 1a, St. James's-street, Old Steyne, Brighton, auctioneer and estate agent, and T. Turner, Stanley-bridge-wharf, King's-road, Chelsea, mason and pavior. Improvements in the making and constructing of carriage-ways.

Dated April 23, 1863.

1007. J. W. Proffitt, land agent and surveyor, Park-road, Peckham, Surrey, and W. L. Duncan, gentleman, 218, Pembroke-cottages, Caledonian-road. An improved mode and apparatus for distributing sand or any other suitable substance or substances on the rails of railways and tramways.

1009. R. Richardson, Great George-street, Westminster, civil engineer. Improvements in railway permanent way.

1011. W. Clark, 53, Chancery-lane, engineer. Improvements in the manufacture of tiles, and in apparatus for the same. (A communication.)

1013. P. McGregor, Manchester, machine maker. Improvements in machinery for spinning and doubling.

Dated April 24, 1863.

1015. J. B. Daines, 5, Little Argyle street West, gentleman. Improvements in the preparation of stone, plaster, compo, iron, wood, and such like substances, so as to preserve them from decay.

1017. J. Lambert, Sheffield, brass founder. Improvements in ball cocks.

1023. J. Thompson, Bilston, Stafford, manufacturer. Improvements in the manufacture of barrels for firearms and other descriptions of tubes, and in apparatus or machinery to be employed for that purpose.

1025. W. A. Shaw, New York, United States. A mode of lining lead pipe with tin or its alloys.

Dated April 25, 1863.

1029. L. De Breanski, Greenwich. Improved apparatus for fixing drills, which invention is also applicable for fixing apparatus for raising, supporting, and suspending weights, and for other analogous purposes.

1031. A. H. Clark and H. Hope, Birmingham, manufacturers. Improvements in valves for water, steam, and gas.

1033. J. P. and E. B. Nunn, Royston, Cambridge, farmers. Improvements in hoes and cultivators.

1037. F. Walton, British Grove Works, Chiswick. Improvements in the manufacture of fabrics for covering floors and other surfaces, and in the apparatus employed therein.

1039. I. Dimock, machinist, Manchester. Improvements in machinery for cleaning, sorting according to size, and doubling silk and other threads.

1043. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improvements in breech-loading firearms. (A communication.)

Dated April 27, 1863.

1045. S. Osborne, Bayswater, stay and crinoline skirt manufacturer. An improved machine for unwinding crinoline steel.

1047. H. E. Carchon, feather dealer, and E. F. Raybaud, hat and bonnet maker, 17, Rue Thévenot, Paris. Improvements in the manufacture of hats and bonnets, and mode of preparing feathers to be used in the said manufacture.

1049. W. E. Gedge, 11, Wellington street, Strand. Improvements in tuyeres or blast pipes, and in apparatus connected therewith. (A communication.)

1051. W. Richards, Birmingham. Improvements in ordnance, firearms, and cartridges.

1053. F. Bennett, Holywell, Flint, metallurgist. An improved method of condensing lead and other metallic fumes and vapours from furnaces.

1055. W. H. James, Old Kent road, civil engineer. Improvements in indicating the locality of fire, applicable also to denoting the position of ships.

Dated April 28, 1863.

1059. S. Ingledew, Stockton-on-Tees, wharfinger. Certain improvements in the method of obtaining iron from its ore, and in the subsequent treatment thereof for converting the product into a metallic state, and in apparatus connected therewith.

1061. S. Crabtree, Bradford, manager. Improvements in balling motions.

1063. A. Kinder, 20, Cannon street, engineer. Improvements in the manufacture of sheet metal, and in ingots or plates of metal, and in the machinery or apparatus employed therein.

1069. T. Moore, 27, Leadenhall street. Improved apparatus for laying down, protecting, and controlling submarine cables for telegraphing from vessels moored off a coast to the shore.

1071. G. Davies, 1, Serle street, Lincoln's inn, civil engineer. An improved machine for agitating and mixing substances. (A communication.)

1073. H. Y. D. Scott, Brompton Barracks, near Chatham, Capt. R.E. Improvements in the manufacture of cementitious substances.

Dated April 29, 1863.

1075. J. Rowley, Stafford street, Peckham. Improvements in the means or apparatus employed for recovering the fibres of wool from fabrics or materials composed of wool combined with cotton or other vegetable substances.

1077. W. Tarr, 112, York street, Oxford street, Manchester, and E. Tarr, 40, Cavendish street, Oxford street, Manchester. An improvement in pianofortes.

1079. E. and F. A. Leigh, Manchester, mechanical engineers. Improvements in cotton gins and in the method of driving the same, part of which improvements is applicable to other purposes.

1081. H. Worms, 27, Park crescent, Portland place. Improvements in apparatus for elevating guns.

1083. F. Gretton, Burton-upon-Trent, brewer. Improvements in heating the contents of mash tuns.

1085. H. W. Ripley, Montpellier lawn, Cheltenham. Improvements in apparatus for printing fibrous materials. (A communication.)

Dated April 30, 1863.

1087. J. Wibberley, Manchester, mechanic. Improvements in machinery or apparatus for winding cotton, silk, wool, or other threads on spools or reels.

1089. W. Clark, 53, Chancery lane, engineer. Improvements in the manufacture of hydrocyanite of ammonia and of alkaline and earthy cyanides. (A communication.)

1091. E. G. Brewer, 89, Chancery lane, engineer. Improvements in welding and rolling metals, and in machinery connected therewith. (A communication.)

1093. J. Appleby, Manchester, tea merchant. Improvements in propelling ships and barges.

Dated May 1, 1863.

1095. J. McFarlane Gray, 80, Prince Edward street, Liverpool, engineer. Portable apparatus or instruments for riveting, caulking, chipping, and otherwise operating upon and treating metals and other substances.

1096. E. Jones, Charlton. Improvements in drainage and in water-closets, and in the means and apparatus necessary for the same respectively.

1097. W. Clissold, Dudbridge, engineer. Improved apparatus for fulling woollen cloths and washing and cleansing woven fabrics.

1099. J. Badart, 9, Bishopsgate street. Improvements in the preparation of rape seed cake, linseed cake, poppy seed cake, niger seed cake, sesseme seed cake, and ground nut cake.

Dated May 2, 1863.

1101. W. T. Smith, Dalston, engineer. Improvements in washing machines.

1103. G. Burt, Birmingham, manufacturer. Improvements in machinery for punching, stamping, or forging metals.

1105. S. J. Bartlett, Maidstone, watch and clock maker. Improvements in apparatus for straining and drawing off liquids.

1107. J. T. and T. Oakley, Grange-road, Bermondsey, engineers and millwrights. Improvements in the construction of garden pumps, part of which said improvements is applicable to fire-engines and other hydraulic machines.

Dated May 4, 1863.

1109. E. R. Southby, Wareham, Dorset. Improvements in the extraction of scents from plants, flowers, and other odoriferous substances.

1110. J. Fortune, Morton, near Bingley, York. Improved means of joining or fastening together lace, blond, quilling, or similar materials.

1111. J. M., E. J., and C. Johnson, Castle street, Holborn, show tablet manufacturers and printers, and L. Bertling, Ironmonger street, St. Luke's, draughtsman. Improvements in the production of show tablets, advertisement tablets, name plates, architectural facings and decorations, and other ornamental, decorative, and inscriptive articles.

1113. G. Haseltine, 12, Southampton buildings, Chancery lane. Improvements in springs for railway carriages and other purposes. (A communication.)

Dated May 5, 1863.

1115. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in the manufacture of wrought iron and steel, and in the apparatus to be employed therein. (A communication.)

1116. W. Walsh, Manchester, manufacturing chemist, Improvements in obtaining and purifying oxalate of soda, which improvements are also applicable to the manufacture of oxalic acid.

1117. R. G. Kent, Old Compton street, Soho, tool and metal warehouseman. Improvements in the construction and arrangement of shades and reflectors for gas lights.

1119. W. Boothroyd, Halifax, bobbin manufacturer. Improvements in stationary engines or apparatus for obtaining motive power.

1123. J. H. Knott, Nelson square, Blackfriars road, engineer. Improvements in pumps.

1125. W. C. Wilkins, Long Acre, lighthouse engineer. Improvements in lamps.

Dated May 6, 1863.

1127. T. Sagar, Burnley, machine maker, and J. Wilkinson, foreman. Certain improvements in power looms for weaving.

1129. W. E. Gedge, 11, Wellington street, Strand. An improved toy. (A communication.)

1131. S. D. MacKellen, Manchester, watch manufacturer. Certain improvements in watches and other timekeepers.

1132. I. M. Singer, Glasgow, gentleman. Improvements in sewing machines.

1133. G. Davies, 1, Serle street, Lincoln's-inn, civil engineer. Improvements in machinery or apparatus for forging and dressing horse-shoe and other nails. (A communication.)

1135. A. Sturrock, Doncaster, engineer. Improvements in locomotive engines and tenders.

Dated May 7, 1863.

1148. T. Holliday, Huddersfield, manufacturing chemist. An improved blue colouring matter.

1150. A. Skwarcow, 24, Leadenhall-street, merchant. Improvements in the construction of turntables. (A communication.)

1152. J. S. Grimshaw, Huncoat, near Accrington, spinner and manufacturer. Improvements in looms for weaving.

1156. W. Clark, 53, Chancery-lane, engineer. Improvements in coating wrought or other iron to protect it from corrosion or oxydation. (A communication.)

Dated May 9, 1863.

1162. S. Wilson, Manchester, engineer. Improvements in hoops or bands for fastening bales, and in machinery or apparatus for making the same.

1164. J. Norie, Glasgow, ironfounder. Improvements in making moulds for casting, and in apparatus therefor.

1170. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the manufacture of lamp black. (A communication.)

1172. J. Burrell, 85, Back Church-lane, Whitechapel. Improvements in machinery for cutting the teeth of bevelled wheels.

1174. J. Burrell, 85, Back Church-lane, Whitechapel. Improvements in salinometers.

Dated May 11, 1863.

1178. R. Burgess, Manchester, engraver. Improvements in machinery or apparatus for marking, etching, or engraving cylindrical and other surfaces.

1182. J. Parkinson, Titchbourne-street, Regent-street. A new or improved mode of manufacturing tablets to be used for monumental purposes.

Dated May 12, 1863.

1188. W. Mattison and G. Barker, Leeming-bar, near Bedale, York, iron founders. Improvements in grass mowing and reaping machines.

1194. H. L. Emery, Sloane-street, Chelsea. Improvements in apparatus for manufacturing saws suitable for ginning cotton and for other uses. (A communication.)

1196. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in spring mattresses, sofas, chairs, seats, and similar articles. (A communication.)

Dated May 13, 1863.

1198. H. Rushton, 48a, Northampton-road, Clerkenwell. Improvements in head-dresses.

1202. F. Holthausen, 40, Rue de Richelieu, Paris, manufacturer. An improved portable copying press.

1204. V. J. Cassaignes, 8, Rue des Fosses, St. Jacques, Paris. Improvements in stereoscopes.

1206. B. Lambert, 35, Lothian-road, Camberwell New-road. Improvements in paper-makers' rag or pulp engines.

Dated May 14, 1863.

1210. T. Lawrence, Salford, Lancaster, mechanic. Certain improvements in machinery or apparatus used in the processes or operations of drying, dressing, brushing, waxing, and finishing fabrics.

1212. A. Pilbeam, Glasgow, gentleman. Improvements in sewing machines.

1214. J. Burrell, 85, Back Church-lane, Whitechapel. Improvements in the construction of cocks or valves.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated May 14, 1863.

1218. G. T. Bousfield, Loughborough Park, Brixton. Improvements in machinery for rolling, grinding, and cutting files and rasps. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, May 26, 1863.

105. J. T. Stroud. Fixed and portable lights for domestic and other uses.

106. C. H. Townsend and J. Young. Compositions for preventing incrustation and corrosion in steam boilers and condensers.

129. E. Howes. Railway, ship, and other lamps.

134. R. Ferrier. Wet gas meters.

135. L. P. Josse. Apparatus for cleansing wheat or other grain or seeds.

137. J. P. Bath. Omnibuses.

141. W. E. Newton. Microscopes. (A communication.)

150. J. Edwards. Manufacture of buttons.

156. W. E. Newton. Manufacture of buttons. (A communication.)

164. J. J. Lundy. Manufacture of metallic casks and vessels.

171. H. A. Bonneville. Colouring, bronzing, and preserving iron and steel. (A communication.)

187. E. Bazin. An improved log.

192. H. Caro and J. Dale. Obtaining colouring matters.

193. H. Holcroft. Machinery for separating substances of different specific gravities.

198. J. M. Binger. Paste or composition to cover the rollers used by letter-press printers.

203. T. Lambert. Apparatus for drawing off water or other fluids.

223. R. A. Brooman. Manufacture of anvils. (A communication.)

243. H. B. Barlow. Preserving timber. (A communication.)

252. F. W. Wymer. Steam engines.

259. E. G. Muntz. Securing axles and axle boxes.

271. C. H. G. Williams. Manufacture of red colouring matters.

274. W. Clark. Condensation of steam. (A communication.)

374. R. Saunders. Pavements and floors.

423. S. W. Clough. Signalling on railways.

424. W. Nalder. Rotary screens.

475. E. T. Hughes. Treatment of colouring matters derived from tar for the purpose of making them applicable for painting. (A communication.)

558. W. Gray. Manufacture of beaters for thrashing machines.

593. J. Henderson. Carpets.

913. H. W. Ripley. Preparing and printing wool and other fibres. (A communication.)

1007. J. W. Proffitt and W. L. Duncan. Distributing sand, or any other suitable substance or substances, on the rails of railways and tramways.

1025. W. A. Shaw. Lining lead pipe with tin or its alloys.

1029. L. de Bréanski. Fixing drills; also applicable for fixing apparatus for raising, supporting, and suspending weights.

1048. J. J. Robert. Spoons and forks.

1111. J. M., E., and C. Johnson and L. Bertling. Show tablets, advertisement tablets, name plates, &c.

1132. I. M. Singer. Sewing machines.

1140. P. Bourne, Miners' lamps.

1218. G. T. Bousfield. Rolling, grinding, and cutting files and rasps. (A communication.)

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 22, 1863.

3167. T. M. Elton.
3170. J. Steinthal.
3171. F. Palling.
3174. J. R. Danks, B. P. and R. P. Walker.
3176. J. Halford.
3179. T. Keyworth.
3180. W. T. Rowlett.
3181. D. Auld and D. Auld, jun.
3183. D. Veerkamp and C. F. A. V. Trigt.
3415. G. E. M. Gérard.
3422. F. Parker.
3473. H. A. Bonneville.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending May 23, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2671	0	6	2798	0	4	2809	0	4	2820	0	4	2831	0	4	2841	1	0
2701	0	4	2799	0	4	2810	0	10	2821	1	4	2832	0	10	2842	0	8
2731	0	4	2800	0	8	2811	0	8	2822	0	8	2833	0	4	2843	0	4
2790	1	10	2801	0	4	2812	0	10	2823	0	4	2834	0	10	2844	0	4
2791	0	4	2802	1	0	2813	0	8	2824	4	4	2835	0	4	2845	0	4
2792	0	4	2803	0	10	2814	0	10	2825	0	10	2836	1	0	2846	0	10
2793	0	4	2804	1	4	2815	0	4	2826	0	8	2837	0	4	2847	0	4
2794	0	8	2805	2	10	2816	0	10	2827	0	4	2838	1	0	2848	0	4
2795	0	4	2806	0	8	2817	0	8	2828	0	4	2839	0	4	2849	0	6
2796	0	4	2807	0	4	2818	0	6	2829	0	4	2840	0	4	2850	0	4
2797	0	10	2808	0	4	2819	0	8	2830	0	4						

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	p ct.
IRON:—									
Welsh Bars, in London	per ton	6	10	0	to	0	0	0	2½
Nail Rods	do	7	0	0		7	5	0	
Hoops	do	8	10	0		8	15	0	
Sheets, single	do	9	10	0		9	15	0	
Staffordshire Bars	do	7	10	0		8	0	0	
Bars, in Wales	do	5	10	0		6	17	6	
Rails	do	5	10	0		6	0	0	nett
Foundry Pigs, at Glasg, No 1	do	2	10	6		2	15	0	
Swedish Bars	do	11	10	0		12	0	0	2½
STEEL:—									
Swedish Keg, hammered ...	do	16	0	0		0	0	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts...	do	96	0	0		0	0	0	3
Hammered Bottoms	do	106	0	0		0	0	0	
Flat Bottoms, not Hamrd....	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8¼		0	0	8¼	
Fine Foreign	per ton	94	0	0		95	0	0	
TIN:—									
English Block	per cwt.	6	2	0		0	0	0	2½
do Bar	do	6	3	0		0	0	0	
do Refined	do	6	8	0		0	0	0	
Banca	do	6	12	0		0	0	0	nett
Straits	do	6	7	0		6	10	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	8	6		1	9	6	
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
LEAD:—									
Pig, English	per ton	20	12	6		23	0	0	2½
,, Spanish Soft	do	19	17	6		0	0	0	
Shot, Patent	do	23	15	0		0	0	0	
Sheet	do	21	10	0		0	0	0	
White	do	27	0	0		0	0	0	
SPELTER:—									
On the spot	do	18	0	0		0	0	0	nett
ZINC:—									
English Sheet	do	23	5	0		0	0	0	2½
QUICKSILVER	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	42	0	0		0	0	0	2½

TIMBER, duty 1s. per load, drawback 1s.

Teak ...... load	£12	0	£13	0	Archangel, yellow...	£13	0	£13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
,, yellow pine .	3	10	4	10	Finlan	9	0	10	0
St. John, N.B., yellow	0	0	0	0	Memel	10	0	15	0
Quebec oak, white ...	5	10	6	10	Gothenburg, yellow	10	0	11	0
,, birch	3	10	4	10	,, white.	9	0	9	10
,, elm	3	10	5	0	Gefle, yellow	10	10	11	10
Dantzic oak	3	10	6	10	Soderhamn	9	10	10	10
,, fir	2	10	3	10	Christiania, per C., 12ft. by 3 by 9 in.				
Memel fir	3	5	3	10					
Riga	3	0	3	5	Christiania, yellow	21	0	2	
Swedish	2	10	2	15	DeckPlank, Dantzic, per 40 ft. 3 in.	0	4		
Masts, Quebec red pine	5	0	6	0					
,, yellow pine	5	0	6	0	PUMICE STONE pr ton	5	10		
Lathwood, Dantzic, fm	5	10	6	10	OILS, &c.				
,, St. Petersburg	8	0	8	10	Seal, pale ...per tun	48	[illegible]	48	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	83	10	85	0
					Cod	49	0	50	0
					Whale, Sth Sea, pale	45	0	45	10
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	58	0	59	0
St. John, white spruce	14	0	15	10	Cocoanut, Cochin...	49	0	51	0
Yellow pine, per reduced C.					Palm, fine	37	0	37	10
					Linseed	45	10	0	0
Canada, 1st qual. ...	17	0	18	0	Rapeseed, Eng. pale	51	10	0	0
,, 2nd do.	11	0	12	0	Cottonseed	33	10	42	0

FRENCH & SMITH, Sworn Brokers,
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THE MECHANICS' MAGAZINE.

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The *Daily News*, July 1st, speaking of Benson's Watches in the Exhibition, says:—"Here are arranged a fine selection of watches manufactured by him on the latest and most approved principles of horological science. When we compare them with the specimens of ancient watch-work which are placed beside them, or even with those worn by our grandfathers, the immense advance in this branch of the mechanical arts is at once apparent." Chronometer, duplex, lever, horizontal, repeaters, centre seconds, keyless, split seconds, and every description of watch, from the plainest to the highest quality of which the art is at present capable, and adapted to all climates. Benson's Illustrated Pamphlet on Clocks and Watches (free by post for two stamps) contains a short history of watch-making, with descriptions and prices. It acts as a guide in the purchase of a clock or watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world, to select a clock. J. W. Benson, Prize Medallist, 33 and 34, Ludgate-hill, London.—Established 1749.—[Advertisement.]

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JUNE 5, 1863.

THE BRIGHTON RAILWAY ACCIDENT.

Again our daily journals have had the sad task of recording one of those catastrophes which all our engineering science and mechanical skill seem powerless to prevent. Our readers are by this time too well acquainted with the details of an event which has spread universal consternation, to need further description at our hands.

In the present stage of the inquiry now pending, it is a matter of no little difficulty to determine the immediate cause of the accident. Its ultimate cause is doubtless to be found in the excessive speed, deemed necessary to make up for time previously lost, from causes which we are not just yet in a position to state. Those journals which ought to possess the most accurate information, express curiosity and consternation; wrath towards railway officials, railway directors, railway engine-drivers; all, in short, directly or indirectly connected with an event productive of such lamentable results. But as yet we have none of those details scientifically accurate, because drawn from proper sources, which can alone enable us to pronounce a positive opinion. On one side, we hear the surmise that the engine exploded from the over-pressure required to obtain an excessive speed; from another source, we learn that the engine left the rails first, and exploded afterwards—doubtless, the most correct conclusion. Locomotive engines, indeed, seldom explode when running, with such fatal results. Many instances might be adduced where they have exploded without leaving the rails or doing much damage. It is not quite the easy matter some may imagine, to raise steam to 300 lb. on the square inch, even with a locked safety valve, when an engine is running, as this one is said to have been, at 60 miles an hour. We say 300 lb. solely on the supposition that the engine was in fair working order; of course a channelled or corroded boiler might reduce the limit of strength to a mere trifle over that at which the engine daily worked; but we have no evidence whatever to say that such was the case with the engine in question; nor is it likely that the driver permitted his water to become so short, that overheating the fire-box led to its collapse.

The far more likely conclusion is, that the engine, travelling at an excessive speed round a sharp curve, oscillated so violently as to force out a badly secured rail; and on leaving the track, and falling down the embankment, had some part of the broken machinery forced through the shell of the boiler, when an explosion would be likely enough to follow. The breakage of a connecting rod in inside cylinder engines often enough leads to disastrous results from the forcible entrance of the broken rod into the fire-box shell.

That the oscillation was violent, long continued, and a subject of remark for some time before the occurrence of the accident, is one of the very few facts on which we can with certainty rely. It is just barely within the bounds of possibility that this oscillation might be the indirect cause of an explosion by tearing away some of the plates which attached the boiler to the frame, or the machinery to the boiler. We have before now seen a "motion plate," riveted both to the frame and the barrel of a boiler, completely torn away from the last by the united effects of expansion, and journeys over rough roads, at high speed. In such cases rivet-heads start off, bottom-plates spring, and become so deeply channelled as to render their renewal a matter of necessity. Although it is improbable, it is possible that violent straining on an old and weakened plate might have caused this explosion before the engine left the rails.

The *Times*, in a leader, attributes the accident, or, as it terms it, the "unusual effort," to the fact of the train being 20 minutes late when leaving Croydon. We confess the deduction is too far-fetched for our understanding. Had the article, however, been more grammatical, we might have understood it better. But without, like the *Times*, implying that unpunctuality is a force which can cause a train to leave the rails, we can easily draw the conclusion that the want of punctuality is the most prolific source of railway accidents. Novices in such matters imagine that, the whole system of railway traffic being one of the most complicated under the sun, the slightest departure from the exact times laid down for the setting out and arrival of trains must lead to the disorganization of the whole system. Such does not seem to be the case, however. Our great companies might adopt the mottos, "Time was made for slaves;" they prove themselves free by utterly disregarding it. In such accidents as the present, we see the result.

Whether the intervention of Government would or would not lead to good results, is a question open to discussion. Hitherto, drawing the natural conclusion that the enormous damages should be sufficient penalty on railway companies when accidents could be traced to their negligence, it has not interfered. The deduction would be correct did directors pay for such accidents out of their own pockets; but such is not the case; shareholders, who are blameless, pay; directors escape comparatively untouched. There is such a thing as carrying forbearance too far; and although public companies are too apt to consider the interference of Government officials as a piece of impertinence strongly to be strongly condemned, we think it high time that railway officials should be compelled to keep the time, and observe the bye-laws which experience prove to be necessary to the safety of the passangers who entrust their lives and property to their care; and although we cannot recommend the introduction of a law which would limit speed, we will hail, as a great step in the right direction, such a rigid supervision by proper officials as will ensure the punctual despatch of trains at the hours named by traffic superintendents.

LIGHT LOCOMOTIVES.

Whether much of the odium into which branch lines have fallen with existing railway companies does or does not depend on the mode in which they are worked, is a question which we believe requires little discussion. The defects of existing arrangements by which a 30-ton engine and tender are employed to draw 10 or 15 tons of carriages, and 3 or 4 tons of passengers, ought by this time to have become sufficiently obvious to lead to the adoption of some more economical mode of propulsion. Boards of directors are, however, but fallible, like other men, and too often prefer to adhere, limpet-like, to the dead weight which may almost crush them out of existence, rather than resort to any scheme, no matter how full of promise, to which the hateful word "novel" can be applied.

That the prophecies spoken at the beginning of the railway mania, which foretold a time when every hamlet, if not every farmstead, should have a branch line of its own, will ever be fulfilled, is far more than doubtful. There is certainly no want for such a refinement of intercommunication; a moderate approach to it would, perhaps, lead to the immediate bankruptcy of every railway company in England. Nevertheless, our railway system, extended as it is, hardly yet fulfils all the requirements in its power. Hundreds of towns, towns of 4,000 or 5,000 inhabitants, are still many miles from a railway station—miles sufficient to prevent the railway proving anything like a boon to their commerce or trade. The transport of goods or passengers over a very few miles of turnpike road usually costs quite as much as their conveyance ten times as far by rail. Whole districts, indeed, yet exist which know the benefits of railway communication only by hearsay; and for anything we can see to the contrary, never are likely to experience them practically. Until branch lines pay dividends, their extension is more than problematical.

It is hopeless to expect a fair profit from a few miles of railway with an extremely light traffic, unless its working expenses are light in proportion. The maintenance of the permanent way is always the most serious item in railway disbursements, and it is reasonable enough to expect that on such a line this item should be reduced to the very lowest limit. Were this the case, all would be well; and branch lines being generally found to pay pretty fairly, both directly, and as feeders to the main line, would enjoy a goodly proportion of public favour. But, on the contrary, the half-yearly accounts nearly always show the expenses for maintenance and fuel to be nearly as much per mile as on the main line, with abundantly more traffic. A result sufficiently natural, when we consider that the same class of locomotives work on each.

A branch line having obtained the sanction of Parliament, is constructed at a moderate price, and seems likely to command a fair share of traffic. The permanent way, in order to reduce constructive expenses, is, or at least ought to be, light. The next consideration is the locomotive stock to work it, and this is quickly supplied by some half-dozen engines, considered too antiquated to work the main line traffic. Then we see a 30-ton engine and tender—an old coupled "goods," as often as not—drawing two railway carriages, or perhaps three, weighing about five tons each, and carrying some fifty or sixty passengers. An elephant drawing a Queen's pattern phaeton would not be a whit more ridiculous. The relative weights, indeed, of the propelling powers and the loads drawn, would bear almost exactly the same proportion to each other in each case. The result is apparent enough: at the end of six months the expenses are found enormous, the profits infinitesimal. Nothing remains but to remove the permanent way, if light, and replace it by degrees, at an immense expenditure, by 80 lb. rails, with chairs, &c., in proportion. We do not wonder that shareholders grumble, and directors forswear branch lines for the future.

No policy can be more suicidal, than the practice of an economy which judges it better to work lines of light traffic with heavy engines, simply because they already exist, rather than build or purchase others really suited to the object in view. Such a system of working goes far to prove that both directors and engineers have yet to learn that the actual cause of destruction to the permanent way is to be found in the heavy locomotive, not in the load it draws. Were it but possible to do without locomotives, what an Eldorado would be opened for shareholders! Permanent way would then indeed deserve the title. It could no longer be applied in derision, as it too often is now. But locomotives being necessary evils, the only resource left is to guard as much as possible against the destructive effect due to their weight, by reducing that weight to the lowest limit compatible with the possession of a sufficient amount of adhesion to enable them to perform the duty assigned them. It may often answer to put down a larger engine to drive a factory, or pump a mine, than that actually required at the moment, because many circumstances might arise which would throw an increased demand on the capabilities of the engine. For such contingencies, of course it is well to be prepared; but no argument of this kind can be used in favour of the adoption of heavy locomotives to work light traffic. When that traffic increases, it is easy to replace existing engines with others, heavier and better suited to the increased demand on their powers, while the light machines thus superseded may still do good service on new branches, or other parts of the line where the traffic continues small. After all, we very seldom find such locomotives displaced by their heavier brethren. Strange as it may seem, all experience goes to show that, the smaller the engine, the greater is its proportionate efficiency compared with the dead weight put in motion; indeed, in no case where 10 and 15-ton engines have been employed to perform a duty suited to their powers, have they failed to give the most perfect satisfaction. A consumption of fuel reduced from 22 lb. to 12½ lb. per mile, while transporting the same loads; a 40 lb. or 50 lb. rail outlasting one of 75 lb. or 80 lb.; a proportionate reduction in rolling stock repairs (for a rail cannot be worn out without considerable injury to the wheels and carriages performing the feat); such results soon increase dividends, and lines whose working has been considered almost disastrous begin to pay a fair percentage.

We feel little doubt that light railway carriages, having the locomotive machinery fitted up in one end, on principles long since ably advocated by Mr. Adams and others, would, *cæteris paribus*, supply us with the nearest approach to the theoretical perfection of passenger transport. A pair of 7-inch cylinders, with a 12 in. stroke, in conjunction with suitable boiler and machinery, need not weigh more than 2½ tons, independent of the weight of the framing, which would, of course, be that of the carriage. A large composite carriage thus arranged, and calculated to carry 80 or 90 passengers, should not weigh more than 15 tons. The consumption of fuel would be far below 10 lb. per mile. At least 40 tons of rolling stock are usually put in motion to convey the same number of passengers, with a consumption of some 18 lb. or 20 lb. of fuel for precisely the same duty, on the ordinary system.

But the capabilities of these locomotive carriages do not by any means terminate with their own propulsion. Adhesion is the real measure of the tractive force of every description of locomotive, whether an independent machine or carrying passengers on the same frame. And 8 tons on the driving wheels will supply adhesion enough for a load of 60 tons on steep grades, so that no difficulty stands in the way of coupling two or more additional carriages on when the necessities of the traffic demand increased accommodation. The moderate amount of goods and cattle traffic, which we find on branch lines, could thus easily be carried on without taxing the powers of one of these locomotive carriages to any extent; indeed they have on more than one occasion, under exceptional circumstances, taken their place in main line traffic, and done exceedingly good service while so employed.

Whether the universal adoption of such carriages of a larger and more powerful class, suited to really heavy work, would or would not prove advantageous, must of course remain a disputed question. On our part, we feel no hesitation in saying that such carriages would introduce an element of economy which railway companies would find a positive boon. The hauling about of many tons of dead weight, merely to secure adhesion, cannot be regarded as wise policy. Why not, then, make the increased load aid in supplying the necessary adhesion? A ton of passengers will prove just as effectual in preventing a driving-wheel slipping, as a ton of iron. The transport of the one pays well; the transport of the other is a serious item of expense. Every ton of dead weight we work into a locomotive, may be said to require an additional 5 cwt. to secure the adhesion needful for its own propulsion. The actual cost of conveying passengers is a very small item of expense; trains cost much the same per mile, loaded or empty, simply because the paying load bears so small a proportion to that which does not pay. Where the load is heavy and certain, as on the largest of our main lines, or with a steady mineral traffic, heavy locomotives have been hitherto found indispensable, and have generally paid their way pretty fairly; but, after all, such cases do not really represent more than 60 or 70 per cent. of the entire railway traffic of Great Britain, and there is no reason whatever that the remaining 30 or 40 per cent. should be worked at a loss on the same principle, and by the same engines.

It has been urged that heavy engines are necessary for high speeds, as light locomotives fail to keep time. If coupled to a train whose weight exceeds their powers, this result is likely enough to ensue; but the case would be very different were the 150 or 200 passengers placed in a light locomotive carriage, with high drivers, and of considerable length. We believe that no difficulty would be found in conveying the same paying load, at the pace of our fastest express trains, at much less than one-half the cost, and perhaps with far more safety. The curse of our railway system is that every part almost of our rolling stock is made too heavy; the result is not safety, but destruction and waste. Were it not for the excessive weights placed on our engine tyres to obtain the adhesion necessary to draw, not alone 5 or 10 tons of passengers, but 40 to 100 tons of rolling stock, they would seldom fail; permanent way would seldom be out of order, and accidents far more rare than now.

We cannot, in the space of a short article, enter as fully as we could wish into this important subject; at a future day we may resume it. The whole question of railway economy pivots on the reduction of transported weight to the lowest limit; and the more general introduction of light locomotives should be regarded as an important step in any future attempts at economy.

NOTES OF THE BIRMINGHAM MANUFACTURES.

WE find few engineering establishments in Birmingham which present any features of importance. The manufacture of small goods in iron, brass, or steel may be regarded as its distinguishing characteristic, to the almost total exclusion of the Cyclopean works for which other centres of industry are celebrated. But although within the actual precincts of the town it may be difficult to find an establishment where the construction of heavy machinery is carried on, on a scale large enough to secure the adoption of such mechanical expedients as can alone enable the engineer to conduct his business with profit, a few short trips by rail will bring us to establishments which well repay the trouble. Not the least celebrated in England is the factory where Messrs. Boulton and Watt carry on business at Soho; with little more than a glance at which we must for the present rest content.

We have already stated that it is far from our intention to give detailed descriptions of processes, tools, or machinery with which it is but natural to suppose our readers are perfectly familiar; it is rather our purpose to pick out, as far as possible, such information as is not generally known, and therefore likely to prove interesting.

The present factory is not the original cradle of the steam-engine, in a very accurate sense of the phrase; for that part of the works in which Watt's first engines were built, and most of his experiments conducted, has, we regret to say, been pulled down by the present Mr. Boulton, for reasons which we are not prepared to state. It was situated at a moderate distance from the present factory, which, though in part new, still comprises within its limits many of the old shops in which Watt's ideas were practically developed. Situated within a hundred yards or so of the Soho Railway Station, on the London and North Western, a siding permits the heaviest castings to be loaded directly on the railway waggons in the yard; the canal washes its walls; land is comparatively cheap—a combination of advantages which such establishments seldom possess in the same degree.

On entering the erecting shop, one is struck with its noble proportions, the more remarkable as it is an old part of the factory. One point is worthy of attention—we have never seen a shop of the kind so free from the encumbrances of machine tools; a result due to the judgment observed in placing the planing machines, &c., in situations where they are completely out of the way. The arrangement of some of the planing machines is particularly worthy of attention. Large cylinders, instead of being placed on the moveable tables, and traversed under fixed rests to get up the valve faces, as we find too much the custom, are arranged in a vertical position close to the walls, on suitable beds, to which they are firmly attached; while the tool, fixed in a proper head-stock, which traverses in a vertical frame bolted to the wall, performs its work with the utmost precision. It is, in fact, a vertical planing machine, with a moveable instead of a fixed tool. In another part of the shop is a machine, called a "devil" by the men. It is used chiefly for facing up the flanges of cast-iron pipes, which it does, with sufficient accuracy for all practical purposes. It consists simply of a large face-plate, similar to that of a lathe, the axis on which it is mounted revolving in an ordinary head-stock. Just in front, and nearly on a level with the ground, is a cast-iron table, with suitable slots, to which the pipes are bolted, with the flanges vertical, overhanging the table, and parallel with the face-plate, in the face of which and close to the circumference, are fixed a great number of steel cutting-tools, 3 or 4 in. apart. The revolution of the face-plate causes these tools to true up the flanges of the pipes, &c., with an ease and celerity sufficiently remarkable.

The machinery in this shop is put in motion by a side-lever condensing engine of some 12-horse power nominal. This engine, although extremely old, is of very excellent design and workmanship, and performs its duty with an ease and silence we could wish to see more general. The piston rod has no parallel motion at present, the one with which it was originally fitted, having been removed from some cause, has never been replaced—a circumstance which does not seem to affect its performance in the slightest degree.

The fitting shops present the usual features—interesting enough in many ways, but which we have not space to dwell on. The machinery in them is put in motion by a beam-engine of considerable size, and supposed to be some 70 years old. The attention which it has received prevents the effects of such an extreme old age becoming manifest, and it still performs its duty as perfectly as at first; some of the brasses in the parallel motion are said to be the same originally put in. They have little resemblance to brass in appearance, being more like a dark bronze. Our readers will understand that we do not vouch for the accuracy of a statement which was made to us in perfect good faith. The entire engine is interesting from the associations connected with it, as being one of the very first constructed with an eccentric and crank, instead of tappets and a sun-and-planet wheel.

The foundry arrangements are, as may be supposed, on an extremely extensive scale, every contrivance which can facilitate the different operations being employed. There are two or three casting-houses, the largest being devoted to such works as the cylinders for the "Great Eastern;" for example, there are two casting pits of very large dimensions, so arranged that heavy castings are never raised from them. Most of the floor of the foundry is supported on iron plates and girders. The casting pits are immediately under this floor, so that we may consider the casting as being made in the basement storey. Suitable doors and a tramway are provided; so that when the casting has cooled sufficiently, it only remains to break into the side of the casting pit, which is of brick work, with three sides built solidly and one temporarily, when the casting being slightly raised by a powerful crane in the shop above, permits a low truck to be run under, when the cylinder, &c., can be wheeled to the boring machine close by with the greatest ease; the pit being cleaned and the wall built up again, is once more ready for the moulding.

There are three or four boring machines on the premises; but the one we now speak of is, we believe, the only one of the kind in England: perhaps some of our correspondents could inform us if we err? The boring-bar is upright, 14 in. in diameter, driven from below; it will bore cylinders about 13 ft. in diameter, and about the same stroke; motion is communicated from below by very heavy machinery. The bar stands under a very high and narrow arch, the width of which not being more than some 13 or 14 ft. at once limits the size of the object to be bored, and provides a means of fixing it steadily; heavy iron clamping pieces being bolted to the walls to which the cylinder can be secured. Whether large or small, the article to be bored is brought from the foundry on the proper truck, and being wheeled into place under the bar, raised by powerful tackle for the time, it is lifted off the truck by a number of small jacks, which sustain it during the subsequent process of boring. When completed, the truck is again brought into requisition to remove it to the erecting shop. At the time of our visit, one of the cylinders for the pumps to be erected at Crossness in connection with the southern outfall of the Main Drainage was having the flanges trued up. Perhaps we cannot do better than conclude this article by a slight description of these pumping-engines, which will be not more remarkable for their colossal dimensions than for the singularity of their construction. As they will not be completed for about ten months, we cannot give all the accuracy of detail we could wish; but through the kindness of one of the representatives of the firm, we are enabled to supply information which will be found pretty accurate in the main.

The entire apparatus, then, will consist of an arrangement of four steam cylinders and eight pumps, fixed in an engine-house of large size and handsome design. This house will be divided by floors into three or four storeys, the steam cylinders being on the first floor. The height from the foundations to this floor is about 43 ft., the cylinders being supported by cast-iron columns, webbed and bolted together, their cross section somewhat resembling an ordinary H-girder. The four cylinders, which are each 48 in. diameter by 9 ft. stroke, will stand, as it were, at the corners of a square, in the centre of which a noble staircase will give the means of access to the other floors. Each cylinder will have two overhead beams of cast-iron, 40 ft. long between the centres, and 6 ft. deep in the middle. The cylinders being in the centre, these beams will point towards each end of the engine-house. The two beams of each engine are mounted on a centre gudgeon, 16 in. in diameter between the beams, which will be some feet apart, and about 14 in. in the necks. The bosses which receive this gudgeon are 5 in. thick and 8 in. or 9 in. long, measuring through the beam, the middle webs of which will be 2 in. thick, with stout top and bottom flanges.

The height from the floor on which the cylinders stand to the centres of the beams will be about 26 ft.; a handsome row of cast-iron columns, elaborately decorated, affording the necessary support for their centres. The pumps will be eight in number, each 12 ft. in diameter, consisting of a suction, middle, and delivery piece, bolted together by the flanges. One pump will be erected under each of the beams, and as these are side by side so of course will be the pumps. They are placed at about half-beam, and each cylinder will have four plungers working in it, which will receive their motion through connecting rods, coupled to suitable cross-tails passing through both beams. Each steam cylinder will thus work eight plungers, the four nearest to the centre having a stroke of 2 ft. 3 in., the other four a stroke of 4 ft. 6 in. They are all 57 in. in diameter.

The suction valves will be vertical, instead of horizontal; the lower or suction pieces being cast like a circular open grate, 12 feet in diameter (equal to the full diameter of the pump) the openings, some 30 in number, affording ample water way, a separate leather valve will be suspended from the upper part of each opening; the delivery valves will be the same in principle, but the grate, instead of being circular, will be flat, and bolted on the end of a delivery piece which conveys the water to a trough placed between the pumps and common to both. We cannot give the exact height of the lift, but it will be about 18 feet we believe.

It will be remarked, that the ends of the beam project considerably beyond the pumps; to these projecting ends will be attached connecting rods, which will lay hold of cranks on the ends of shafts carrying two fly-wheels each. We thus find that each engine has one steam cylinder, two beams working eight plungers in two pumps, and two fly-wheels.

The condensers and air-pumps will be placed behind the cylinders, the latter being worked by counter-beam, which acts the part of parallel motions to the piston rods. The valves will be Cornish double-beat, worked without a cataract, by means of cams on a separate shaft which lies directly under the valve-boxes, and driven by gearing from the fly-shaft. The arrangement is one invented and frequently used by Messrs. Boulton and Watt, and is both convenient and simple. As the engines will be worked on a very high scale of expansion, with jacketed cylinders carefully lagged, and steam of a very high pressure, we may expect very economical results.

The boilers will be twelve in number, each 30 ft. long by 6 ft. in diameter. The internal flues will be 3 ft. 3 in. diameter at the firing end, reduced to 2 ft. 11 in. behind the bridge; the grates will be 8 ft. 6 in. long, one to each boiler—a length too great, in our opinion, for good firing. The flues are supplied with water-tubes on Galloway's patent. The boilers will be arranged, in two groups of six each, at either end of a very handsome boiler-house. The smoke-burning contrivances must be very successful to render the gilt ironwork, with which the top of a very gorgeous stack is to be surmounted, effective.

We have already exceeded our space, and must conclude by expressing our thanks for the courtesy which has enabled us to place these interesting details before our readers.

THE INFLUENCE OF THE BLAST IN THE QUALITY OF IRON.

When we consider the immense interests involved in the iron manufacture, it seems strange that the precise influence of the different applications of the blast on the quality of the iron produced in the blast furnace has not been investigated with the care demanded by the importance of the subject. The most eminent men of science are at variance when attempting to explain the principal phenomena resulting from the action of the tuyeres at the hearth.

If we remember that a weight of nearly 14 tons of air is consumed in an hour in some of the large furnaces—an amount nearly three times as great as that of the solid materials; the ore, flux, and fuel—it must be evident that the volume, the density, the hygroscopic state, the chemical constituents, and lastly, the temperature of the air employed, must exercise a powerful influence for good or for evil upon the products of the furnace. The action of the air will evidently not merely confine itself to the "yield" or quantity, but will also exercise an influence on the "make" or quality, of the pig.

The density of the blast employed has a considerable influence on the smelting operations, and it is principally determined by the dimensions of the furnace and the kind of fuel employed. The season of the year also requires some variation in the pressure of the air; and when its density is diminished by the heat of summer, the blowing engine has to make up the deficiency by increased speed, in order that the furnace be supplied with the requisite amount of oxygen. Before the introduction of blowing engines worked by steam, great difficulties were encountered in the use of coke and coal in the furnace. About 2 lb. to the square inch is the minimum pressure of air now employed, and this density is generally increased with the density of the fuel until in some cases it reaches 3¼ lb. to the square inch. Considerable difference of opinion still exists as to the precise shape of the tuyeres and the exact number to be employed. Mr. Truran patented in 1855 (No. 1730), "a mode of constructing nozzle pipes so that they should deliver through one tuyere two or more jets of blast, hot or cold, of like or different densities. The nozzle pipes may be divided by partitions or be double, one being within the other, so that the outer one delivers an annular jet, and the two jets may be supplied from different pipes, and be of different densities or temperatures." We do not know whether this plan has ever been tried. The blast is generally applied by means of three tuyeres, but as many as ten or twelve nozzles are sometimes used. The small tuyere system is especially adopted in Scotland. It is to be regretted that exact data do not exist as to the relative values of the two systems.

The hygroscopic state of the air, or the amount of moisture contained in the atmosphere, is another potent element of success or failure. It is estimated by Mr. Truran that about 25 tons of air are consumed per ton of metal, say dark grey pig iron, and thus, with a make of 120 tons per week, the amount of blast consumed would be 3,000 tons. According to Dalton, the air in England contains about 1·42 per cent. of moisture, in dry weather, and more than double that amount in wet weather, so that we have a quantity of from nearly 50 to 100 tons of water discharged weekly into the furnace. This is, no doubt, the explanation that there is less fuel consumed and a better quality of metal produced in winter than in summer. The increase of make is, in fact, estimated to be from 4 to 5 per cent. greater during the winter months. The chemical constituents of atmospheric air being invariably the same, it could only be by artificial means that any action on the furnace could be sought for by changing the chemical composition of the blast. Various attempts in this direction will be found recorded in Her Majesty's Patent Office. Thus we find one invention (Patent No. 6,948, Old Law), proposing to inject "pure hydrogen gas" into the blast furnace. Apart from the risk of explosion, the great expense in procuring the gas would of itself form an insuperable bar to the practical introduction of this process.

The precise effect of raising the temperature of the injected air to about 610 deg., or the use of the *hot* blast, is still a debateable point with those concerned in iron-making. The question may be briefly divided into three separate heads; the first being the influence of the hot blast on the economy of fuel, the second its action on the quality of the iron produced, the third being the commercial or trade value of the hot blast.

There is no doubt that the consumption of furnace coal is reduced by the hot blast. The saving effected varies greatly with different kinds of coal and ore. Taking the coal used in the stoves for heating the blast into account, the saving effected has been estimated at 3 cwts. of coal per ton of pig iron in Wales, and from 6 to 7 cwts. in Scotland. Various reasons have been given to account for this economy of fuel. By some it has been ascribed to an annulling of the cooling effects of the cold blast on the combustion of the furnace; by others, that a hot blast supports combustion better than a cold blast; the relative proportions of the oxygen and hydrogen on the air are, however, unaltered by the addition of heat. Mr. Truran ascribes the economy effected by the hot blast to a reduction in the quantity of coal required in the furnace from the extraneous heat thrown in by the blast, as a reduced proportion of coal to ore is always succeeded by an increased quantity of iron produced. The amount of coal required in the furnace being thus lessened, there is a less volume of blast required, the additional result being a diminished consumption of fuel in the upper parts of the furnace. Briefly stated, the economy of fuel effected may be ascribed to two causes; the reducing power of the heated blast injected at the bottom of the furnace, and the lesser proportion of carbon in the furnace to the volume of the blast.

With regard to the influence of the hot blast on the quality of the pig, we are still somewhat in the dark. There is no doubt, however, that the use of such a powerful means of acting on the furnace may, in unskilful hands, lead to bad results. Mr. Robert Mallet, in his work "On the Physical Conditions Involved in the Construction of Artillery," ascribed the "much discussed and unquestionable (?) inferiority of hot-blast iron over cold" to unnecessary heat of fusion, caused by an unskilful use of the hot blast. "Unnecessary heat of fusion injures the quality of the metal, as unnecessary heat of 'pouring' injures the quality of the casting. It does this in two ways—by the introduction of foreign earthy and alkaline bases, which greatly reduce the cohesion, and far more by the great increase of surface, produced by extreme elevation of temperature, in the disseminated plates of graphite. These, scattered through the mass, like mica or hornblende in granite, present at their innumerable planes of cleavage almost no cohesion; but these planes are, in accordance with the general law of arrangement, in planes of least pressure, found mainly to coincide in parallelism with those of the crystals of the iron itself (*i.e.*, the carburet of iron, which constitutes the metal of cast-iron chiefly), so that the total deterioration of strength is very great; and this is, in fact, the secret of the much discussed and unquestionable inferiority of hot-blast iron over cold; nothing more than the elevated temperature introduced in the blast furnace." Fully admitting that the injudicious use of the hot blast may produce the injurious effects ascribed to it by Mr. Mallet, we nevertheless differ from him in his sweeping condemnation of the process. To corroborate our opinion, we will further quote the following:—Mr. Hodgkinson, in his report on the experiments on hot and cold blast iron, made by Mr. Hodgkinson and Mr. Fairbairn for the British Association, says: "It is rendered exceedingly probable that the introduction of a heated blast in the manufacture of cast iron has injured the softer irons, whilst it has frequently mollified and improved those of a harder nature, and, considering the small deterioration that the irons of quality No. 2 have sustained, and the apparent benefit to those of No. 3, together with the great saving effected by the heated blast, there seems good reason for the process becoming so general as it has done." Respecting the specific gravity of hot blast iron, we may state that some years ago, Dr. Thomson carefully analyzed the chemical constituents of hot-blast iron, and he found, as a general result, that the specific gravity of hot blast iron is greater than that of cold-blast, and an average of several experiments showed that the hot blast increases the specific gravity of cast iron by about 1-22nd part. Dr. Thomson also found that hot-blast iron contained a smaller proportion of carbon, silica, and aluminum, than cold blast iron.

We now come to what we have termed the commercial or trade influence of the hot blast on the quality of iron.

The best English ironstone is the argillaceous or clay ironstone, and it requires the cold blast to work it in quantities. The iron produced is neither "red short" nor "cold short," and is thus never brittle, whether hot or cold. What is called "cinder" is the refuse of the puddling surface. It contains a large percentage of iron, combined with impurities that have been expelled by the puddler from the good iron, or "mine." The power given by the hot blast in extracting the iron from amongst these impurities has greatly increased the production; but the produce is rendered very inferior by an admixture of this material. It is called "cinder iron." We do not assert that the hot blast injures the quality of the iron. As we mentioned before, its precise effect has not been ascertained with any precision. But we have seen that the hot blast may be used to extract iron from any material, from the best to the worst. The cold blast can only be applied to the best ore and fuel, it cannot be used to make "cinder iron;" and thus the very name of "cold blast iron" is to some extent a guarantee as to its quality. The introduction of the hot blast has thus been a great benefit as regards *quantity* of produce, but as regards *quality*, it has offered facilities for "scamping" the work, of which, unfortunately, but too many have availed themselves. The hot blast has also been the means of permitting the ironmasters to use raw or uncoked coal, instead of the desulphurized coke. It is evident that more impurities are liable to be worked up with the iron when raw coal is employed. The Scotch coals are generally so unfit for coking that they often lose 55 per cent. in the process, and the introduction of the hot blast, by greatly economizing the coals there employed, has raised the iron manufacture of Scotland to its present importance. Within twenty years the make of iron in England has been trebled; in 1840 the total produce was a little less than 1,400,000 tons; in 1860 it was more than 4,150,000 tons. This progress, however, is more of a striking than solid character. Of the 1,400,000 tons of iron produced in 1840, 770,000 tons of this quantity was cold blast iron; of the treble quantity in 1860, only 150,000 tons were produced by the cold blast. Figures, however, do not give a true account of the produce of the iron manufacture. Mere quantity is a very rough estimate; quantity and quality combined ought to be taken into account. Double the resisting powers of the iron produced, and for many applications less than half of the quantity is required.

The value of raising the temperature of the blast is thus another point upon which much difference of opinion still exists. As we have seen, some say that hot-blast metal is greatly inferior to cold-blast, in contradiction to others who assert the contrary opinion. The exact amount of economy of fuel effected by the use of this process is another subject of dispute. No definite data exist that would warrant our drawing conclusions as to its precise influence on the molecular structure and chemical constituents of iron. We consider that this great uncertainty is a disgrace to the iron manufacturers as a body; and without overlooking the fact that a strict inquiry into the matter would, involve great expense and difficulty, we nevertheless consider it very extraordinary that the exact value of a process employed for the last 35 years, is still involved in obscurity. The fact seems to be that the manufacturers, on the one side, ignore the deductions of theoretical science; while, on the other, laboratory chemists refuse to consider the practical requirements of manufacturing on a large scale. The only means of arriving at the truth would be by the labours of a scientific commission, meeting the iron-makers on their own ground. The usual way adopted in England in encountering these questions, is to summon a host of witnesses before a Parliamentary Committee of Inquiry, and the culminating result of this expensive procedure is a voluminous blue-book, which is read by nobody. The evidence given is, no doubt, often very valuable in its way; but who is to separate the grains of wheat from the mass of chaff? This separation could only be effected by the light of science; not by orators from parliamentary benches, but by chosen men, taken from the forge, the laboratory, and the workshop.

There are many phenomena in the manufacture and use of iron, verified by the practical experience of manufacturers and engineers, which are, as yet, unexplained by science. On the other hand, many of the later important discoveries in science have not been utilized by the manufacturer. Let the ethereal spirit of science incorporate itself in the flesh and blood of practice, and the union would result in a "mens sana in corpore sano."

The questions involved in the quality of iron are no longer private questions of profit and loss and of each man's safety and comfort; by the recent alterations in shipbuilding, the national honour and security, are made to depend upon an abundant supply of good iron. In case a naval battle should ever be fought within reach of our shores, the command of the Channel would fall to the Power capable of repairing and refitting iron ships with the greatest celerity. We have seen, by the recent conflict at Charleston, how damaging a naval action is likely to be to the ships engaged; and we must not forget that the French are still in advance of us in their arrangements for docking large vessels of war. The safety and honour of England depend upon her navy; but that navy must not be dependent upon the chances of trade and the "scamping" of contractors and manufacturers. It thus becomes a question which English iron-manufacturers would do well to consider, whether the Government will not have to manufacture a portion at least of the iron required for the national defences. While wood only was used for vessels of war, the Admiralty found themselves obliged to have complete command over the supply of that material; iron now takes the place of wood, and a similar result with regard to its supply may ensue. We do not advocate that the Government should manufacture all the iron it requires; we only wish that the Government should be raised above the accidents and frauds of trade.

We often hear it vaguely stated that French iron is superior to our own, but we have no sufficient data from which we could draw a conclusion. There were certainly some very fine samples of iron from France, Germany, Belgium, and Sweden in the late Exhibition. In the Swedish Department there was a very remarkable sample of iron from that country. It consisted of the keel of an iron paddle steamer, 200 ft. long, and built at the Mortala Works. The vessel struck on a rock while steaming at a speed of eight or nine miles per hour; and although the plates bent into a most extraordinary shape, they show no fracture, and the ship arrived safely at Stockholm. A medal was obtained for this exhibit; and we remember that the question was facetiously discussed in the Exhibition as to the person who really deserved to bear away the honours. Should the medal be given to the maker of the iron, or to the builder of the ship, or rather to the pilot who tested the iron by steering it on to the rock? Seriously, however, this specimen of iron from Sweden shows what might be done with iron to ensure safety at sea; and it affords a lamentable contrast to the late disaster with the "Anglo-Saxon," which has involved the loss of upwards of 200 lives, and about £100,000 in money.

CONVERSAZIONE OF THE SOCIETY OF CIVIL ENGINEERS.

THE annual *conversazione* of the Society of Civil Engineers was held on Tuesday evening, at the society's house, 25, Great George-street, Westminster. The contents of the rooms combined many objects of interest, most of them comparatively novel. In one of the upper rooms a very complete and instructive collection of works in aluminium and aluminium bronze proved extremely attractive. The beauty of the articles fabricated from the latter alloy leaves no doubt that, as far as appearance at least goes, a perfect substitute for gold has at length been discovered—one, too, which bids fair to excel in truthfulness and beauty of appearance any of the alloys which have hitherto rendered the imitation of silver a task so much easier than the imitation of gold. The extreme lightness of aluminium, combined with a fair amount of richness, points it out as extremely suitable for the construction of such articles as scales for mathematical instruments, &c. The alloy of 10 parts of aluminium with 90 parts of copper seems likely to prove one of the most valuable materials we have yet discovered for the construction of ordnance.

In the large hall, we noticed a very fine micrometrical instrument by Whitworth. The standard calipers also exhibited seem to be really useful instruments which no engineering establishment should be without. We would call attention to a comparatively recent invention, not so generally known as it ought to be. We mean buckled plates—a very fair specimen of which, suited for safe doors, stood at one side of the room. These plates, although very light, are of immense strength, and would be found very suitable for floorings, or any other purposes where large surfaces are required to sustain heavy weights without much trussing. We have an idea that a very excellent steam boiler could be constructed by the aid of this very simple invention.

Models of Price's patent railway signals stood near; but from want of the necessary information, which was afforded neither by an attendant nor suitable papers, we are unable to say aught of its merits. Wright's permanent way sleepers, close by, appeared to contain a good idea which may be further developed at a future day.

The models of shipping were not the least interesting objects shown. Amongst others, we noticed beautiful models of the "Northumberland" and other iron-plated ships. Edwards's "shoal water indicator" seems likely to prove useful. It consists of a long bar, which can be projected from the ship's bottom, near the keel, to a depth of a couple of fathoms. It is steadied by suitable guys, and by very simple arrangements rings a bell placed on deck the moment the vessel takes water so shallow as to permit the projecting bar to touch the bottom. It seems likely to prove a substitute for the lead in many instances.

Muntz's Patent Metal Company exhibited one of their recent inventions for sheathing iron ships. The principle is as follows:—A large number of holes of small diameter are drilled about ¼ inch deep in the iron plates forming the ship's side. A sheet of india-rubber is then so applied that it not only covers the iron perfectly, but also enters the holes, completely stopping them up. The sheathing plates are then applied outside of the india-rubber, and are secured by suitable nails or screws driven into the india-rubber plugs which fill the holes. The principle seems strange, but there is no question that the sheathing was attached in a first-class manner to the plates exhibited. We much fear that the expense of drilling the holes would be found a very serious item in carrying out the invention on a large scale.

Grivel's "self-acting skid" is, we believe, correct in principle and extremely simple; by means of it the train cannot run backwards should a coupling break. Its use might prevent such accidents as that on the Oxford and Worcester railway. We feel little doubt something of the kind has long been wanted. Archbut's new theodolite also shows numerous advantages which civil engineers will not be slow to appreciate. The telescope can easily be rotated on its longitudinal axis, so that the errors of collimation can easily be corrected. A slightly conical enlargement on the centre of the telescope rotates within a strong conical ring, to the inside of which it is accurately ground, and fitted much as an ordinary tap is to its outside casing. The workmanship is excellent, and shake is impossible; even after years of wear it is only necessary to draw the conical band further into the ring to make all tight as at first.

It would be quite out of the question to attempt even an enumeration of the many novelties shown. We believe there has rarely been a *conversazione* of the society which has proved more generally interesting. The attendance was very large, embracing most of the leading scientific men of the day. The arrangements for securing the enjoyment of those present were, as usual, perfectly successful; and few who were there can look back with any feeling but that of pleasure to the scientific reunion, which has been a leading incident of the week.

STEAM FIRE-ENGINE COMPETITION.

OUR readers will have seen, by a notice in our advertizing columns, that the trial of Steam Fire Engines, originally fixed to take place on the 1st of June, is deferred to the 1st of July. The committee have not vouchsafed to give any reason for this unexpected postponement; it is pretty well understood, however, that "The Favourite" could not be got ready in time. Foreigners were invited to enter the lists with English manufacturers; and two steam fire-engines have already arrived in this country from America, under the idea that the trial would come off at the time originally appointed; it is to be hoped, therefore, that ready or not ready, no further postponement will be permitted.

Much dissatisfaction having been expressed at the manner in which the Exhibition trials of fire-engines were conducted, in Hyde-park last summer, it is to be hoped that upon this occasion some well-defined programme, to be mutually agreed upon by the Prize Committee and the competing manufacturers, will be laid down, and rigidly adhered to; and that nothing like partiality on the part of any member of the committee, or sharp practice on the part of any competitor, will be permitted.

It has been remarked that the hon. secretary of the committee has hesitated to give definite explanations, when applied to, upon the ground that he is only one of many who compose the Prize Committee; but, by virtue of his office, he is the organ of the many, and ought to be prepared to answer all inquiries that may be addressed to him.

It is to be hoped that the canvas catch-water receptacles, used in Hyde-park last summer, will not again be employed; they are bad in principle—worse in their construction and application. Instead of an orifice opening into an enlarged chamber, it opened into a diminishing one, the consequence of which was, that a large proportion of the water thrown forcibly into the hoods rebounded out again—the more compact and powerful the jet, the greater the loss from this cause. It was noticed that while one of the broken jets lodged the whole of its spray within the receptacle, a more compact and solid jet rebounded backward, almost on to the branch-man. A scientific writer who was present gave it as his opinion that, "the canvas hoods afforded no fair test of the quantity of water thrown, and the results were hardly worth recording. In many of the trials, more than half the water, apparently, fell outside of the hoods and upon the ground, and in others the discharge from one engine was blown in spray into the gauge-box of a rival engine."

Such an experiment, made under the most favourable circumstances, could not possibly be either conclusive or satisfactory, involving, as it inevitably does so many disturbing elements.

The form, material, and lay of the hose, the more or less perfect form of the nose-pipe, the force and variation of the wind (especially if crossing the line of fire), and, above all, the skilfulness or awkwardness of the branch-man, so largely influence the results, that no positive or trustworthy data can be founded upon such trials.

At no previous trials of fire-engines were there so many scientific men or experienced firemen present, as in Hyde-park in June last, one and all of whom condemned the canvas hoods. Whatever programme may be decided upon, one thing suggests itself as desirable upon the forthcoming competition—viz., that in order to ensure even-handed justice, as between the prize-givers and the competing parties, two umpires and a referee should be chosen, to whom all disputed points could be referred.

BRIEF BIOGRAPHIES OF INVENTORS OF MACHINES FOR THE MANUFACTURE OF TEXTILE FABRICS.

By Bennet Woodcroft, F.R.S. London: Longmans. 1863.

It is natural that we should feel interested in those from whom we have derived benefits, which are all the greater because they are so universal in their application that they have almost ceased to be regarded as matter worthy of attention. Next in importance to the air we breathe, and the food which supports us, we must rank the materials which clothe us. Textile fabrics have long been a necessity of man's life, without which we should cease to exist. True, their origin dates back to the remotest period; but the mere possession of the means of supplying any article universally required is of little avail, unless it can be supplied at such a moderate price as will place it within the reach of every class requiring it. Cotton goods would little avail us if they cost a guinea a yard. Blankets would be out of the reach of many at £20 a pair. Yet, were it not for the facilities of production placed at our disposal by the individuals whose short biographies we have here before us, such prices would be the rule. Twenty years before Parliament granted £5,000 to Crompton, Mr. Pollard, of Manchester, spun yarn of 278 hanks to the pound weight (equal in length to more than 132 miles) upon one of Crompton's mules from cotton worth 5s. a pound, grown in the island of Tobago; he sold this yarn for 20 guineas a pound to the Glasgow manufactures to be woven into muslins intended to compete with Indian fabrics that were selling at 10 and 12 guineas a yard. Little more than 70 years have elapsed, yet now the finest muslins are within the reach of the most moderate income.

Mr. Woodcroft's little volume supplies a want long felt. Much general information regarding the lives of men who have conferred lasting benefits, floats about in a loose way, which renders it difficult to get at; here we find a valuable mass of information condensed and rendered easy of access. The merit of the book speaks for itself; and we give the life of one not generally known even by name, Joshua Heilmann as a specimen.

To the nine individuals whose biographies Mr. Woodcroft has given us, we are mainly indebted for the rise and progress of the cotton manufacture, a progress which we cannot illustrate better than by using Mr. Woodcroft's own words. "In 1760, at the accession of George III., the entire value of cotton goods manufactured in England was about £200,000 a-year. In 1860 it was estimated at upwards of £52,000,000. In 1772 British calicoes were made to the number of 50,000 pieces. In 1816 upwards of 1,000,000 pieces were manufactured. 1750—Population engaged in cotton manufacture about 20,000. 1801—Persons engaged about 80,000. 1823—10,000 steam looms in Great Britain. 1862—Their number was 399,992, driven with a power of 297,000 horses, and employing 451,000 work people, in 2,887 factories, containing 30,387,457 spindles." But for Crompton, Cartwright, Kay, Roberts, &c., we should never have had such facts as these.

We cannot peruse the work without a sigh. It is a record of genius unrewarded, unsympathized with in its struggles, perishing miserably, the victim of an ungrateful world. It is a record sufficiently powerful to dissuade any but the most determined from venturing on the thorny path of invention, which seldom indeed leads those who enter on it to a result which can encourage others.

Joshua Heilmann

Was born at Mulhouse, France, on the 19th of February, 1796. Having received a commercial education, he commenced an apprenticeship in his father's office, in 1811, where he laboured for a couple of years, employing his spare time in making drawings of machines. In 1813 he was employed for some time in his uncle's banking-house in Paris, where he devoted his leisure hours to mathematical studies. In 1815 he performed the duties of cashier and book-keeper in his father's house.

In 1816 his friends determined to establish a small cotton-spinning factory; and his uncle, Risler Heilmann, placed young Heilmann for a short period in Messrs. Tissot and Rey's spinning factory at Paris. During this year of sojourning in the capital, he employed his time most industriously. Having entered as a student at the Conservatoire des Arts et Métiers, he attended a special course of lectures on physics. He took lessons in turning, almost daily, from a toymaker, and spent every Thursday in studying the machines of the Conservatoire; his Sundays were employed in drawing the machines at Messrs. Tissot and Rey's factory; and he visited the workshops of Paris to collect information on the subject of various manufactures.

On returning to Mulhouse, in the year 1817, it was proposed that he should be employed in the small factory of Messrs. Heilmann and Son; this arrangement, however, did not take place, in consequence of his family projecting the establishment of a spinning-mill at Vieux-Thann, in which he was to undertake the mechanical department. At that period there did not exist in Alsace an engineering establishment capable of making the required machinery, so that upon Joshua Heilmann, at the age of twenty-two, devolved the responsibility and labour of founding, unaided, a spinning-mill of 100,000 spindles. He made all the drawings, superintended the construction of all the machines, and succeeded in setting the mill to work before 1819.

For some years he superintended the factory of Vieux-Thann, and during this period his leisure time was devoted to the improvement of machinery connected with textile and other manufactures. In 1821 he projected the establishment of a foundry and a machine-shop in connection with it, but this project was abandoned. He then undertook the construction of two windmills for working lifting-pumps; one for the irrigation of the plains of Oxenfeld, and the other for the environs of Mulhouse.

In the year 1823 Heilmann began to occupy himself with power-loom weaving, and he invented several improvements in looms for weaving cotton goods. A number of looms upon his plan having been set to work in the establishment of Vieux-Thann, arrangements were made with Messrs. Risler, Brothers, and Dixon, to introduce the invention into public use; and, on the 10th of June, 1824, a French patent was obtained in the names of those gentlemen. The improved looms were noted for their simplicity and economy of manufacture.

Heilman's attention was directed, in 1826, to the improvement of preparation machines used in cotton-spinning.

On the 27th of March, 1828, he obtained a French patent for an improvement in roving machinery, which, however, did not find favour with spinners.

The establishment of Vieux-Thann having been affected by various commercial crises, passed into the hands of strangers, and Heilmann rejoined his family at Mulhouse. The idea of producing an embroidering machine now occupied his attention. He learnt the art of embroidering from his wife, and in six months' time he had constructed a machine in which twenty needles were caused to embroider simultaneously. For this machine he obtained a French patent on the 9th of March, 1829; and, on the 2nd of May following, an English patent for the invention was granted to Henry Bock, to whom it had been communicated by the inventor. One of these machines was exhibited at the Exposition of 1834 in Paris, and the central jury awarded a gold medal to Heilmann, who obtained also the decoration of the Legion of Honour as an acknowledgment of his ingenuity.

On the 8th of April, 1830, he secured a patent in France for an improved loom, in which rotary or wheel temples were used for keeping the fabric distended; but he soon abandoned this invention.

In the year 1833 he invented a machine for measuring and folding fabrics, which was also exhibited in the Exposition of 1834. Of these machines he constructed about a hundred. A French patent for this invention was dated February 3, 1834.

In the same year the employment of the "bobbin and fly frames" of the English spinners increased more and more in the French factories. Heilmann directed his attention to them, and invented some improvements, for which he obtained a French patent, dated June 30, 1834, and a French patent of addition for further improvements on the 22nd of August following. Heilmann's improved machine was not well received by the French spinners; he therefore came with a model to England, and soon sold his invention; but the house by which it was purchased did not work the machine.

About the year 1835 weaving again formed his favourite study; and he devoted himself to the improvement of the manufacture of silk stuffs. The project was favourably entertained by influential persons interested in the manufacture, who placed at his disposal the capital necessary for carrying out his inventions on a large scale; and in a short time 120 looms, on the improved plan, were set to work by Heilmann at Mulhouse, and a like number at Avignon. In order to effect the improvements in the manufacture of silks, he introduced a series of improved preparation machines, including a weft-winding engine, for which a French patent was obtained on the 23rd of February, 1838, in the names of Messrs. Nicholas, Koechlin, and Brothers. Unfortunately, the whole management of this undertaking had to be borne by Joshua Heilmann, who could not make it commercially successful, and, therefore, it was abandoned. He likewise devised a method of communicating motion to machines by means of iron wires, in place of straps, and put it in operation in Messrs. Koechlin's manufactory at Mulhouse.

He next invented a loom for weaving simultaneously two pieces of velvet, or other piled fabric, united by the common pile to both, and also an improved knife and traversing apparatus for separting the two fabrics by cutting the pile through the middle. For these inventions, together with the weft-winding engine before referred to, an English patent was obtained on the 19th of January, 1841, by Frederick Steiner, on behalf of the inventor. A patent was obtained in France for the loom and cutting apparatus, dated May 18, 1841, by Heilmann, in his own name. For several years he made great exertions to get these inventions into use in England, but did not succeed.

In the year 1843, in concert with Mons. J. J. Bourcart, he again took up a subject previously entertained by them, of combing long-stapled cotton. To the full development of this project Heilmann devoted the remaining years of his life. He sought not merely a simple preparation machine for cotton, but a new system of machinery for the preparation, by combing, of various textile, materials used in the industrial arts, such as cotton, wool, silk waste, flax, hemp, &c. The perfected machinery formed the subject of patents obtained in France, December 17, 1845, and in England, February 25, 1846.

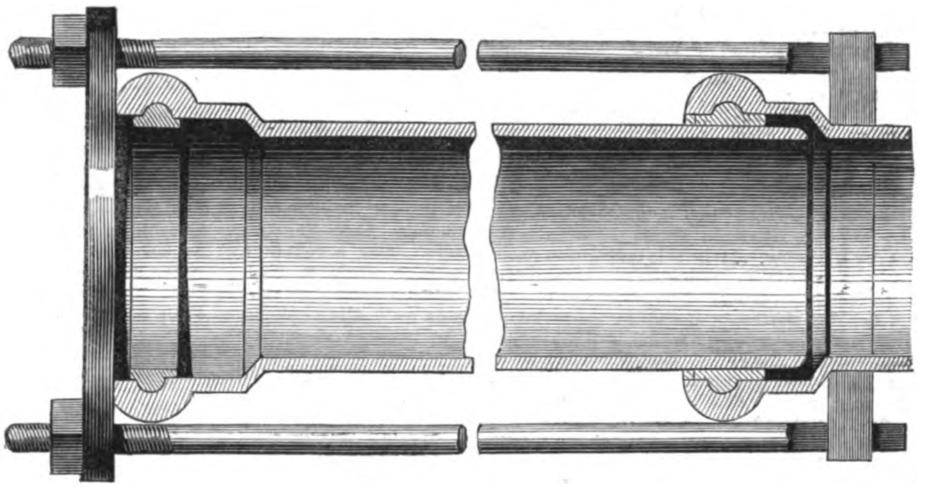
The nature of the machinery may be explained by the following extract from the English specification, in which the invention is stated to consist:—"Secondly, in a new combination of machinery for the purpose of combing cotton, as well as wool and other fibrous materials; into which machine the fibres as they come from the dressing machine are introduced in a lap, sliver, or fleece, which is broken asunder, and the fibres are combed at each end, and the long and short fibres are separated—the long ones being united in one sliver, the short ones in another; and they are passed out of the machine thus separated, ready for drawing, roving, and other subsequent operations." Mr. Heilmann told the writer that the most novel and valuable part of this machine, which he had long unsuccessfully endeavoured to obtain, was ultimately accomplished by carrying into mechanical operation a suggestion that occured to him whilst watching his daughters comb their hair. He was at the time meditating on the hard fate of inventors generally, and the misfortunes which befell their families. This circumstance being communicated to Mr. Elmore, R.A., was embodied by him in a picture, which was exhibited and greatly admired at the Royal Academy in 1862.

The inventor lived to see his combing machinery in full practical operation in France; but he was not spared to extricate himself from the debts he had incurred in giving this his most valuable invention to the world. He expired of consumption, on the 5th of November, 1848, at Mulhouse, where his remains were interred.

His executors introduced this machinery into England under the protection of Heilmann's English patent; and novel and useful as it was, it would have been appropriated in Yorkshire to private purposes had not the strong arm of the law interposed, and thereby allowed Heilmann's ruined family to reap solid advantages from machinery which has proved of incalculable benefit to this country.

The draft specification of his combing machinery, written by himself, is in the possession of the writer, at the Patent Office.

ROBBINS, KEAN, AND CASE'S PIPE-JOINT.



ROBBINS, KEAN, AND CASE'S PIPE-JOINT.

A PATENT has just been obtained by Messrs. R. C. Robbins, J. M. Kean, and H. L. Case, all of Jersey City, for "an improvement in the construction of the joints of cast-iron gas and water mains and other pipes," as illustrated in the accompanying engraving, and which they describe as follows:—

This improvement in the construction of the joints of cast-iron and other pipes, consists in making such joints by forming grooves or recesses around the interiors of the sockets or larger ends of the pipes, making the smaller ends slightly taper, casting rings of lead or other soft metal or alloy within the aforesaid grooves or recesses before putting the pipes in the ground or into the places they are to occupy, and afterwards drawing or forcing the taper smaller ends tightly into the rings.

The socket has an enlargement on the end, having an appearance on the exterior of a very large bead, instead of the small one usually formed thereon; and in the interior of the socket at this enlargement, we form the hollow before mentioned. To fill this hollow with the lead necessary for the junction, we bore, or otherwise form, a hole through from the outside, and place a former mould core, one part of which fits in the socket, and while the remainder is reduced to the size of the pipe end to be placed therein, a disc of india-rubber material, fitting the interior of the socket, is placed on the end of the former; this, with the shoulder of the former, limits the breadth of the annular form of lead to be run into the socket, which occupies a position somewhat similar to the lead ordinarily introduced for such junctions, which is much less in breadth, and enlarges into the recess before mentioned. The former is readily removed by detaching the india-rubber disc, and the lead remaining in place. The smaller ends of the pipes are made taper for a short distance, and, in order to cast these taper ends, and portions of the cylindrical exteriors of the pipes as true and smooth as possible, the ends of the moulds in which they are cast should be composed of a ring of cast iron which has been bored out perfectly true and smooth; this ring is placed on the core before placing the latter on the mould, and, by adjusting this ring along the core, the pipe may be cast longer or shorter as desired. In this way the lead, or other metal or alloy used, may be put in place before the joint is made, which is performed by simply forcing the small end of the one pipe into the lead lining of the socket of the adjoining pipe, which may be done by any suitable apparatus. An apparatus we use is very simple, consisting simply of two half-rings, which is placed behind the socket of the joint to be made, and apply eyes or loops formed on two long rods, which keep the half-hoops together; the other ends of the rods have screws and nuts jointed to the end of the pipe to be forced into the socket; a bar stretched across the end of the pipe receives the pressure of the nuts and strain exerted to force the joint home. The mouth of the socket in front of the groove or recess, may be made somewhat larger than the back portion of the interior of the socket, to permit the introduction of a caulking tool, to caulk the ring if at any time necessary.

MOLECULAR CONSTITUTION OF STEEL.

KARSTEN observed that by the action of acids upon soft steel, a graphitic substance is obtained as a residue, which is not obtained by the action of acids upon hardened steel. This substance he represented to be a definite carburet of iron FeC^4. Berthier also stated that cast steel contains another carburet, CFe.

M. Caron* infers, from the results of numerous analyses, that these carburets are probably mere variable mixtures of carbon and iron, in which the iron is protected mechanically by the carbon from the solvent action of the acid.

He has experimented upon steel in three different conditions—

1. Steel as it comes from the cementation chambers.
2. The same steel hammered for a long time.
3. The same steel hardened.

By the action of hydrochloric acid on these three kinds of steel, the quantities of graphitic residue obtained are very different, being for 100 parts as follow:—

	Graphitic residue.	Carbon.	Iron.	Silicium.
Ordinary steel	1·624=	0·825	0·557	0·242
Hammered steel	1·243=	0·560	0·445	0·238
Tempered steel	0·240=	trace.	trace.	0·240

These results show that the effect produced by tempering is to some extent produced by hammering, and the quality of the steel appears to improve in proportion as the carbon is intimately combined with the iron.

In the same manner forging, which improves the quality of steel, also reduces the quantity of carbon that is separated by solution in acids. Rolled steel gives more graphite than hammered steel. The influence of heat in this respect is the reverse of that produced by hammering and tempering, and re-heated steel does not recover its primitive quality, or its chemical properties, as regards acids, until after it has been hammered or tempered.

White pig iron presents the same variation in the quantity of carbon that it contains in a free state, and the duration of the annealing. However long this may last, there is still some carbon remains uncombined.†

In the tempering of steel, the rapid cooling has a compressing influence upon the metal, almost instantaneous, and presenting the closest analogy with the blow of a hammer.

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* *Comptes-Rendus*, lvi., 43.

† *Comptes-Rendus*, lvi., 211.

A bar of steel rapidly heated to the temperature requisite for tempering, and immediately plunged into cold water, underwent the following alterations of bulk:—

	Before Tempering.	Red hot.	Tempered.
Dimensions in centimetres	20·00	20·32	19·95
	1·00	1·03	1·01
	1·00	1·03	1·01
Volume, ditto	20·00	21·557	20·351

The effect produced by the tempering consists in a rapid approximation of the particles acting in every direction. It is this concussion which M. Caron regards as producing the combination of the iron and carbon. The increase of temperature has the effect of dilating the metal and giving to the molecules a mobility necessary to enable them to unite; the sudden cooling bringing them rapidly together, causes combination.

A bar of iron heated to bright redness was briskly hammered on an anvil covered with finely-powdered carbon; when it had cooled to a dull red heat, it was suddenly plunged into cold water. Some parts of the bar were then found to have been converted into steel at the surface, and resisted the file. The same iron heated to redness, and cooled in the midst of charcoal without being hammered, did not present any trace of being converted into steel when tempered in the same manner.

Hammering does not effect so complete a combination as tempering, because it causes the concussion of the particles only in one direction, while the sudden cooling in water causes their concussion in every direction simultaneously. Moreover, the temperature of the metal after hammering tends to destroy the combination that has been effected by it. On the contrary, the metal being quite cold after the concussion produced by plunging it into water, no further reaction is possible, except by heating the metal again.

Reaumur* and Rinman† state that the volume of tempered steel is 1-48th greater than that of soft steel. Karsten,‡ on the contrary, says that it is not quite certain that all steel expands by tempering, and becomes of less density. In M. Caron's experiments on this subject, he heated the steel in earthen tubes filled with hydrogen. A bar of hammered steel, 1 centimetre square and 20 centimetres long, was tempered, and found to be reduced in length to the extent of half a millimetre; the other dimensions were increased 0·06 mm.; the density was rather less than before, 7·796 in place of 7·817. These differences being small, the experiment was repeated several times with the following results:—

	Before tempering.	After tempering 10 times.	20 times.	30 times.
Dimensions in centimetres	20·00	19·50	18·64	17·97
	·94	·96	·97	1·00
	·93	·96	·97	1·00

Hence it appears that the reduction in the length of bar after thirty temperings was nearly one-tenth. The diminution in length was not due to oxidation, and the sharpness of its edges was retained almost entirely. The bar was then cleaned, and the density found to be 7·743; consequently the volume had increased.

Similar experiments with a great number of bars of steel gave like results, and M. Caron concludes, that in tempering, steel bars are reduced in length, while the width and thickness augment in the same proportion as the density is reduced.

The opinion expressed by Karsten, and the differences observed in steel of different manufacture, induced M. Caron to continue his examination to drawn and sheet steel, with the following results:—

	Dimensions before tempering.	Dimensions after tempering.
Round drawn bar steel .	20·05	19·98
	1·16	1·16
Rolled steel (German plates) . .	20·00	20·45
	1·51	1·51
	3·70	3·70

These results, and those already given, show that in tempering—

1. Hammered steel bars are reduced in length.
2. Round bars partly hammered and partly drawn are scarcely altered in length.
3. Plate-steel increases both in length and width.
4. In all cases the density diminishes—a result which agrees with M. Regnault's observation, that soft steel is denser than tempered steel.

It appears, therefore, that a bar of steel may, in tempering, change its dimensions in a different manner, according to the mode of its manufacture. This accounts for the fact that slender articles, such as files, become twisted; this would naturally be the result if, in forging, one side were more hammered than the other. At the moment of immersion in water, the side that has been most hammered diminishes in length more than the other, so giving rise to the defect.

The effect of the sudden cooling of steel in tempering, may be compared in other respects to the effect produced by the blow of a hammer. Thus, the more sudden it is, the more considerable is the corresponding force exercised, and the greater will be the hardness. This may be inferred from the following table, representing the time of cooling of a bar of steel, and the corresponding degrees of temper produced in the metal:—

	Water.	Water.	Water with 10 per cent. dextrine.	Alcohol.
Original temp. of the liquid	10°	50°	10°	10°
Final temp. of the liquid...	22°	61°	23°	30·5°
Time of cooling	4''7	11''3	13''2	21''7
Degree of temper...............	good.	slight.	very slight.	none.
Shortening of the bar.........	1-28	1-147	1-172	insensible.

The result of a great many experiments with various liquids—mercury, saline or acidulated solutions, water covered with oil, or containing in solution mucilaginous or syrupy substances, oil, &c.—appeared to indicate that the hardness and other characters produced by tempering are inversely proportionate to the square of the time of cooling.

M. Deville* regards these results as accordant with the results of his observations on the remarkable physical and chemical properties communicated to substances by rapid cooling, or, in other words, the excessive proportion of latent heat, or heat of constitution, they retain when suddenly cooled.

Those observations showed that substances might, in this respect, be divided into two very distinct classes.

One class comprises sulphur, selenium, silicium—or rather its compounds, silica and silicates—and the experiments of Jacquelain, Lavoisier, and Silliman justify the addition of carbon to these. The other class includes lead, tin, bismuth, and probably metals generally. The substances of the former class are "superfusible," and capable of being tempered, and acquiring the vitreous or amorphous condition. The substances belonging to the second class present the same molecular condition after cooling either rapidly or slowly, their density remaining constant.

M. Deville considers that the results obtained by M. Caron may be explained by regarding iron and carbon as belonging respectively to these two different classes. Those results and Karsten's show that iron and carbon combine at a high temperature; that if the compound is allowed to cool slowly, the constituents crystallize separately, the mass acquires a maximum density, and acids effect its separation into iron and a graphitic substance. On the contrary, when the cooling is sudden, the carbon remains in a state of superfusion, and communicates the property to the compound containing it in the same manner that silica communicates this property to alkalies and metallic oxides.

When the proportion of carbon is larger than in steel, rapid cooling gives white pig iron, and slow cooling grey pig iron.

From this point of view, steel may be compared to glass, which becomes divitrified when it is heated, or to sulphur, which becomes octahedral sulphur when heated to near 100° C. It is, indeed, worth inquiry whether in the tempering of steel, the effect produced is not absolutely similar to that observed in tempering sulphur; that is to say, the production of two distinct layers, one superficial and very thin, the other internal, and corresponding respectively to insoluble and soft sulphur.

In any case, the sudden approximation of the molecules determined by tempering, and compared by M. Caron to the effect of hammering, maintains permanently a greater distance between the molecules than their gradual approximation by slow cooling.

As regards heat of constitution, there is in such a case a retention of a certain quantity of heat, which is, on the contrary, disengaged during slow cooling. This is the condition which M. Deville terms superfusion.

In the case of the different kinds of allotropic sulphur, it has been possible to some extent to measure the quantity of heat evolved during the transformation of soft sulphur and insoluble sulphur into octahedral sulphur. In the case of steel, the density and calorific capacity afford only indirect evidence of the existence of similar conditions.

M. Deville considers that not only carbon is capable of converting iron into white pig iron or steel, but that, in accordance with the views above expressed, any of the electro-negative elements placed in the same condition as carbon would have that effect. Nitrogen he considers to be especially suited for this purpose.—*Chemical News.*

THE SOILS OF ENGLAND.

(*Concluded from page* 390.)

The property of soils to store up food for plants is thus not confined to one particular kind of fertilizing matter, but it applies to them all, and manifests itself in a way which is modified by the composition of the soil.

In these, and in all other experiments which I have since made, the ammonia, potash, phosphoric acid, and other fertilizing matters contained in a solution were never completely absorbed by any soil, however weak or concentrated the solutions were that were filtered through the soil. Indeed, if the solution of saline matters which are brought into contact with soil are very dilute, scarcely any absorption of ammonia, potash, or phosphoric acid takes place.

Sewage of towns, on account of the very diluted condition in which this liquid is usually found, in percolating through a soil scarcely leaves any of its soluble constituents in the soil in a fixed or less soluble form, although the soil possesses in a high degree the power of absorbing and retaining soluble fertilizing matters.

All soluble saline matters, however useful or necessary they may be, impede the rapid growth of plants if they are presented too abundantly or in too concentrated a solution to the roots of plants. One of the functions of the soil appears to be to transform such readily soluble compounds into combinations so little soluble in water, that they pass in common life as insoluble, but which are still sufficiently soluble to supply the growing plant with the necessary amount of mineral food in a state of solution.

This beautiful power of soils thus not only effectually prevents the waste in fertilizing matters which heavy rains would otherwise occasion, but also rectifies in a great measure any misapplication which may be made of concentrated soluble fertilizers.

The power of soils to modify manuring matters depends in a great measure on the chemical composition of the soil, and also on the concentration of the liquid and the quantity of soluble fertilizing matters which is incorporated with that portion of the soil which is penetrated by the roots of plants. Hence the effect which one and the same manure is capable of producing varies greatly in different soils, and also with a rainy or dry season.

The office of the soil is not merely to supply mineral food to plants, but also to manufacture, so to say, crude food into a condition fit for assimilation; to prevent injury to the living plant by too large an accumulation of soluble matters in the surface soil; to store up for future use such an excess; to diffuse it equally in that portion of the land reached by the roots of the plants; and to modify it in conformity with the requirements of our crops, in a manner differing with each description of land.

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* "L'Art de Convertir le Fer Forgé en Acier," p. 338.

† Rinman, I., 220 to 228.

‡ Karsten, III., 380.

* *Comptes-Rendus*, lvi., 325.

Respecting the causes of the absorbing properties of soils, the opinions of chemists are divided. Liebig regards this power as analogous to, if not identical with, the physical power which charcoal possesses in retaining colouring matters, and consequently considers the soluble fertilizing matters which are brought into contact and absorbed, either wholly or partially, by the surface soil, as present in what he calls a physical state of combination.

Professor Way, on the other hand, believes the absorption to be due to the presence of certain double silicates of alumina in the soil. Thus, for instance, the double silicate of alumina and soda when brought into contact with lime, according to Way, parts with its soda and takes up lime. When the double silicate of alumina and lime thus formed is brought into contact with magnesia, lime passes into solution, and a double silicate of alumina and magnesia is formed; this in its turn is decomposed by a salt of potash; and the double silicate of alumina and potash by a salt of ammonia; thus finally, a double silicate of alumina and ammonia is produced.

Such displacements indeed took place on repeating Way's experiments; but when a preparation made after Professor Way's directions, and containing silica, alumina, and ammonia, is mixed with an excess of a solution containing a salt of potash, ammonia passes into the solution and potash is absorbed by the preparation. From a similar preparation containing silica, alumina, and potash, an excess of a solution of a lime salt removes potash, and the lime becomes absorbed.

But as in no case I have been able to notice a substitution of one base for another in equivalent proportions, and no double silicate of a definite composition can be produced by Mr. Way's plan of operation, and the existence of such definite compounds in soils has never been demonstrated, I would suggest a different cause or causes which are in operation when potash, ammonia, and other fertilizing matters are fixed in the soil.

The absorption of soluble fertilizing matters by soils, I believe may be readily explained by a reference to well-known chemical facts. The absorption of soluble phosphates or phosphoric acid is readily explained by the affinity which carbonate of lime, oxide of iron, and alumina, which occur in every fertile soil, possess for phosphoric acid.

In the absorption of potash and ammonia, I am of opinion that the hydrated oxides of iron and alumina in the soil have a great share. Like all bases of the formula $R^2 O^3$, these oxides in a hydrated condition, in relation to strong alkalies, are weak acids, in consequence of which they have a tendency to unite with potash or ammonia under favourable circumstances.

The absorption of ammonia, potash, and of phosphoric acid by soils accords with well-known chemical facts; and as these substances are by far the most important fertilizing agents, it may be maintained that the principal absorptive properties of soils are due to chemical and not to purely physical causes.

The mechanical or physical condition of soils, however, affects very materially their productive powers; and it is only in a soil in a proper physical condition that the chemical properties can properly manifest themselves.

Great stress is laid by Liebig, as it is indeed by all good farmers, on the mechanical cultivation of the land. Liebig directs special attention to the physical state of combination, as he calls it, in which the mineral matters must exist in the surface soil, in order that they may be of utility to the plant. Whatever may be the precise meaning of the term "physical state of combination," or whether we assume that mineral food must be presented to plants in solution, or in some other mysterious form variously represented in Liebig's "Laws of Husbandry," certainly mineral food cannot be of any service to plants except it be present in the surface soil in an available form. The word "available," perhaps conveys as correct a meaning as the more novel and less graphic expression, "physical state of combination."

In such an available condition mineral food cannot be brought into the surface soil, unless water can freely percolate through the land. This is effected by various mechanical means, such as subsoiling, trench-ploughing, surface stirring, &c. By all these means the porosity, and with it its capillary attraction, is improved. As soon as continued dry and warmer weather sets in and vegetation makes a fresh start, the mineral food prepared previously in the lower strata of the soil begins to move in an upward direction. With the evaporation of moisture from the surface, fresh food is conveyed into the surface soil by capillary attraction, and thus the fertility of the latter is again restored. The appearance of nitre, and similar saline efflorescences on the surface of soils during long-continued dry weather, sufficiently shows the display of capillary attraction.

This explains why the exhausted surface of land abounding at a greater depth in mineral riches, remains unproductive when it rests on an impervious undrained subsoil; why winter-fallow does not materially restore the fertility of the surface if it is not accompanied by repeated ploughings, subsoiling, and similar mechanical operations, tending to increase its porosity; and why in a well-cultivated clay soil vegetation is most luxuriant when the intervals between wet and dry weather are neither too short nor too prolonged.

Looking at the different soils of England, we meet with two extremes—naturally barren sands and rich fertile clays. Between these two extremes we find all gradations: some partaking more of the characters of the one class, and others more of the properties of rich clay land.

Many originally barren soils, by dint of abundant manuring, the cultivation of green crops, which are consumed on the land by fattening sheep, by the purchase of oil-cakes and other kinds of concentrated food, and the increased production of home-made manure, have been brought into a high state of cultivation. But although in this improved condition they yield large crops of wheat, barley, and roots, it can hardly be said that their permanent fertility has been materially increased. Left to themselves, they soon again become unproductive, and therefore require constantly a renewal of those constituents which are removed in the crops grown on such land. High farming, in reference to light sandy soils, restores to the land infinitely more mineral matter of the most valuable kind than is removed in the corn-crops sold off the farm. As regards such land, high farming cannot therefore be called a system of robbery.

Deep, rich clay-soils, on the other hand, often contain, practically speaking, an inexhaustible supply of potash, phosphoric acid, magnesia, soluble silica, &c. The amount of mineral matter taken from such land by a long succession of the most exhausting crops is quite insignificant in comparison to that existing in 12 or 18 in. of soil.

The actual state of fertility of land, however, does not so much depend upon the absolute amount of mineral plant-food in a given depth of soil, as upon the proportion which exists in the surface in an available condition, or as Liebig calls it a "physical state of combination."

Mechanical cultivation, the judicious use of ammoniacal manures, the restoration of particular mineral matters which, like phosphoric acid, are most speedily removed from the surface and alternate cropping, are some of the means of repairing the fertility of the surface.

On light sandy soils, deficient in potash, phosphoric acid, and other mineral matters, ammoniacal salts or nitrate of soda should be avoided; but on soils abounding in mineral food, such dressings may be used with great advantage,

Ammoniacal salts certainly increase the solubility of mineral matters and promote their diffusion in the soil. Still, making all allowance for this, they appear to have a special effect on some crops and not on others. Thus cereals are improved by them, but not clover or beans. In a series of most valuable experiments by Messrs. Lawes and Gilbert, the plots continually manured with mineral matters produced only a slightly increased crop of wheat, nor was the produce increased to any extent in those years in which mineral manures were put on the land every alternate year; whereas in the years in which ammoniacal salts were applied alternately one year and mineral matters the following, a very great increase in the wheat crop was obtained, which was likewise the case when ammoniacal salts were continuously used year after year.

With regard to the relative importance of the various fertilizing matters, it may be stated that ammonia or nitrates unquestionably are most useful substances, which the intelligent farmer may turn into profitable account, and the unreasoning one often abuses in a high degree.

But as the atmosphere as well as the rain invariably contain both ammonia and nitric acid, and as all cultivated soils contain both ready-formed ammonia and nitrogenized organic matters, which on gradual decomposition furnish ammonia or nitric acid, or both, the application to the soil of nitrates or ammoniacal salts is not of the same essential primary importance as that of those mineral matters in which the land is deficient. Magnesia, lime, silica, sulphuric acid, chloride of sodium, and even potash, are either present in most soils in great abundance, or if deficient in particular soils, may be economically incorporated with them in the shape of marl, burnt clay, or gypsum, by the consumption of purchased food on the land. All these mineral matters have much less value than phosphoric acid, which is but sparingly distributed in most soils, and is largely required by all plants. Accordingly the removal of phosphoric acid from the land leads more rapidly to partial exhaustion, especially of naturally poor soils, than the removal of any other ash-constituent. Fortunately modern science and commercial enterprise have brought to light the fact, that large deposits of phosphatic materials occur far more abundantly in various parts of the world, than was supposed not many years ago.

[Of the phosphatic materials actually used in England for the manufacture of artificial manures, the following were exhibited:—South American bone-ash; Cambridgeshire and Suffolk coprolites; apatite from Norway; phosphorite from Estremadura; Sombrero, or rock guano, and phosphatic crusts, from Monk's Island, Jarvis Island, Baker Island, and various other small islets in the Caribbæan Sea.]

Should the supply of Peruvian guano come to an end, which it will before many years, English agriculturists will still continue to reap the benefits which commercial enterprize, manufacturing skill and capital, more extended agricultural knowledge, steam-power applied to the cultivation of the land, intelligent labour and applied science have already conferred upon this highly-favoured country.

Conclusive proofs can be given, showing that so far from being in a progressive state of exhaustion, the productiveness of the soils of England has wonderfully increased during the last fifty years; and that the deplorable but hitherto unavoidable loss which the sanitary laws of a civilized country necessitate, is perfectly insignificant in comparison with the immense amount of mineral riches in the great majority of soils, and with the abundant restoration of fertilizing matters to naturally poor land.

The first street locomotive seen in Berlin made, on Monday week, its second journey to Trepton. It is of about 9-horse power, and draws two large passenger carriages. The machine, which cost £600, is built on the system of Aveling and Porter, and promises to turn out a success.

LINDEMANN'S BRICK MACHINERY.

FIG. 1.

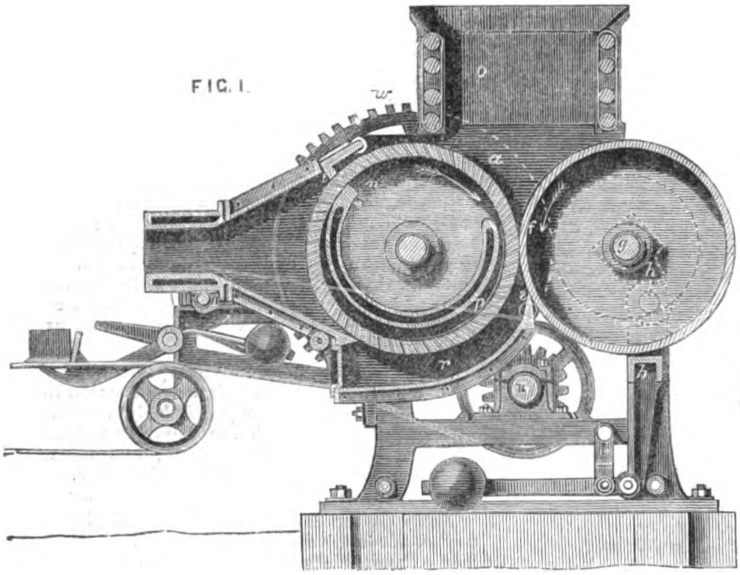
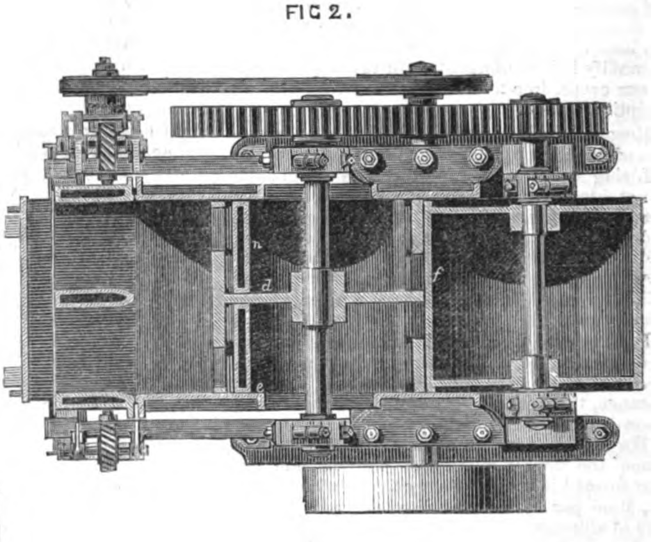


FIG 2.



LINDEMANN'S BRICK MACHINERY.

The annexed engravings represent a machine for making bricks, tiles, or other articles, recently patented by Mr. G. Lindemann, of Salford. The invention consists in forcing the plastic material through slits or other openings formed around the periphery of a cylinder, and through which it is again propelled so as to be delivered to any convenient receptacle or at once into moulds. When the articles are formed by being forced through moulds and then cut off, they are caused to abut against a surface retained by levers, which, when the material has been severed, turn downward, and deposit the moulded article on to a travelling apron or other such apparatus.

Another part of the invention relates to the construction of hoppers for delivering plastic materials to rollers or other apparatus which are to operate upon it, and consists in forming the sides of such hoppers of travelling surfaces.

Fig. 1 is a longitudinal section, and Fig. 2 a plan view in section. *a* is a cylinder mounted upon a shaft *b*, and provided with a number of slits upon its periphery. These slits are in four rows, two of them being situate on each side of a disc, which constitutes the connection between the cylinder and its shaft *b*. The cylinder *a* is without ends, and runs against the framing *e* of the machine. In contact with its periphery is another cylinder *f*, mounted upon a shaft *g*, which is carried by a lever *h*, capable of turning upon a fixed centre at *i*. The lower end of this lever is connected by a link to a bell-crank lever *l*, mounted upon a centre and carrying upon its longer arm a weight; by this weight therefore the cylinder *f* is caused to bear against the periphery of the perforated cylinder *a*. At *n* is a curved plate formed in two parts, one on each side of the disc, and situate therefore within the cylinder *a*. This curved surface is fastened at each end to the stationary framework, and does not therefore revolve with the cylinder. The operation of this part of the invention is as follows:—The clay or other plastic material is placed in a hopper *o*, and it falls therefore be tween the two cylinders *a*, *f*, which are caused to revolve in the direction of the arrows. The material being pressed against the cylinder *a* by the cylinder *f*, is forced through the slits in the former, which as it continues so revolve, conveys it downward into the space *p*; and as this space narrows from the bottom towards the upper end, and as the material cannot otherwise escape, it is again caused to pass through the rows of slits in an uniform plastic condition, free from stones or other such matters, and it may thus be received into any convenient receptacle to be subsequently moulded by any ordinary process. The plate *n* is hollow, for the admission of steam if desired. During the operation above described, any stones which would cause an obstruction act upon the cylinder *f* so as to cause it to overcome the weight, and the said cylinder will then turn bodily upon its centre of motion *i*, and allow the stones to fall downward into a receptacle *r*, from whence they may be removed through a doorway. *s* is a scraper for keeping the surface of the cylinder *f* clean, and *t* is another scraper acting after the same manner upon the cylinder *a*. The main driving shaft *u* has upon it a pinion taking into a wheel *w* upon the axis of the cylinder *a*, which wheel gears into another mounted upon the shaft of the cylinder *f*. The moulding of the material is effected in the following manner:—A mould or die is fitted to the front of the machine, and as the material passes through the slits from the inside of the cylinder it is forced forward into the die; as the material passes through the die it is cut off and transferred to an endless apron or belt by means of weighted levers, as clearly indicated in the engraving. As the apron moves onward the moulded article is carried with it, and the weighted lever raises a kind of box to receive another brick to be transferred to the apron as before.

SPENCE'S NON-CONDUCTING COMPOSITIONS.

Mr. J. Spence, of H.M. Dockyard, Portsmouth, has patented an improved composition for preventing the radiation or transmission of heat.

Instead of employing felt and wood lagging with sheet lead covering or other additions as a covering for steam boilers, cylinders, pipes, and such like, for preventing radiation therefrom, or the transmission or passage inward or outward of heat or cold, the patentee applies a composition consisting of the following materials, or the chemical equivalents for the same, combined in or about the proportions herein stated, according to the purpose or the character of the vessel or body for which the coating or covering is intended.

In these non-conducting compositions argillaceous earth is ground and beaten up, and mixed with water so as to form a paste. To the paste is added oil cake, fish or train oil, cow hair, and carbonaceous matter, for giving consistency, and character, or colour according to the purpose for which the composition is required. The hair is well opened and beatened in or incorporated, and the whole is mixed and compounded until it has obtained the requisite degree of density or consistency.

For coating steam boilers and such like vessels subject to great heat, and for other similar purposes, the patentee takes 1,000 lb. in weight of argillaceous earth, and grinds or beats it up and mixes it with water, and so forms a paste; to this is added about 24 lb. of oil cake, about 3 gallons of fish or train oil, and about 24 lb. of cow hair, 24 lb. of soot, and 3 lb. of bone dust or bone ash; these are thoroughly combined together, and form a plaster or composition capable of being applied in the manner of plastering walls and other surfaces.

For coating steam pipes or steam-engine cylinders, and other such bodies and surfaces, the composition is composed of 1,000 lb. of argillaceous earth, prepared as before, and added to this about 30 lb. of oil cake, 2 gallons of fish oil, about 36 lb. of cow hair, 14 lb. of soot, 18 lb. of bone dust, and 14 lb. of ground carbonaceous matter; these are well-incorporated in a finely-divided condition, as before stated. For purposes where a finer quality of coating is required, there may be less oil, less cow hair, and dry matter introduced in proportion to the weight of clay.

For a finishing coat to the previously described compositions, the following composition may be made:—To each 1,000lb. of argillaceous earth, about 1½ or 2 gallons of fish oil, about 32 lb. of cow hair, about ½ gallon of linseed oil, 24 lb. of ground charcoal, and about 8 lb. of glue, to these may be added 8 lb. of paint or colouring matter of any colour or tint which may be preferred.

Steam boilers may be coated whilst in use, and the composition may be applied by hand or trowel, to a depth of ¾ in. or so, and scored or grained across, and allowed to dry, and then a second or any additional number of coatings may be added.

For coating circular pipes, or such like surfaces, a layer of small hay or straw bands saturated in the composition (or any other convenient material) may be lapped or coiled around the pipe or vessel, and the composition plastered on and the coatings or layers added at intervals. Wood laths may be introduced, and any of the well-known means of bonding or binding may be employed, according to the form of the body to which the composition is to be applied, and according to the nature of the action to which the material is to be subjected.

AMERICAN IRON-CLADS.

The *Scientific American* says:—The 11-inch turrets of the "Roanoke" are to be clothed with three additional inches of iron in (as we are informed) solid plates. A space is left between the original turret and the addition thereto, which is to be filled with some fibrous substance; the particular value of the last feature is not apparent. The "Roanoke's" sides are clad with 4½ in. iron on

TURNBULL'S MILLS FOR GRINDING GRAIN.

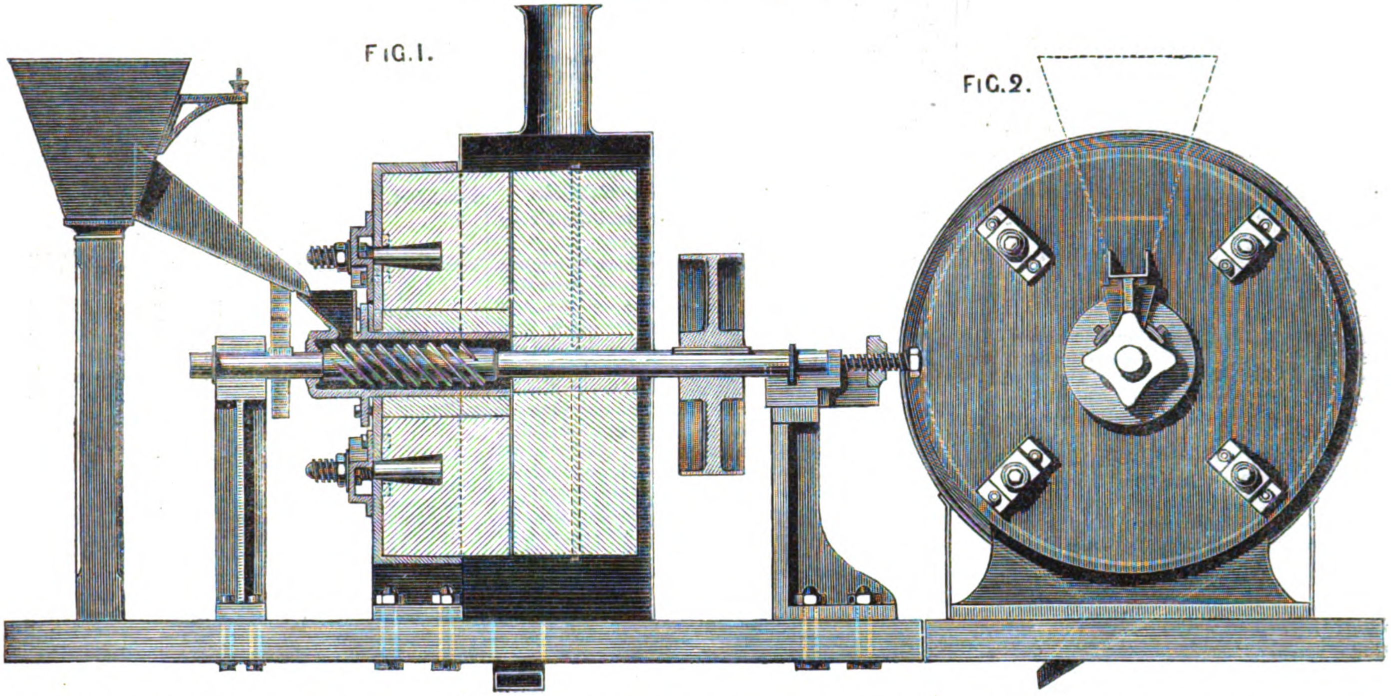


FIG. 1.

FIG. 2.

the old hull; whether this thickness of iron is sufficient to be comparatively invulnerable is extremely questionable. The query suggests itself that if 11 in. of iron, disposed in the strongest manner to resist assault, are insufficient, what will become of 4½ in. of iron on plain snrfaces? The "Mound City," so says the *Telegraph*, received a shot through her 2½ in. solid plating which passed through both sides of the vessel, in all 5 in. of iron. We do not learn that any change is to be made in her construction.

The "Onondaga," at Greenpoint, N.Y., the battery built by Mr. Rowland for the contractor, Mr. George Quintard, of the Morgan Iron Works, is undergoing very important changes in her plan and construction. This vessel had an armament of 4½ in. iron plates fastened directly to an iron hull without wooden backing of any kind. It is now intended to place 12 in. of wood over the 4½ in. plating, and to line this wood on the outboard side with a plate 1 in. thick. The wood will be of oak; 9 in. of it will be laid with the grain at right angles with the ship's length, and the additional 3 in. will consist of planking. The turrets ("Monitor" plan) are also undegoing a change, so we are informed; as it is thought that these improvements will add materially to the effectiveness of the ship. No through bolts will be used in fastening on the wooden facing of the "Onondaga," but the armour will be suspended, as it were, from the deck. This plan has also been recommended for the turrets of the "Monitor" batteries.

It is also said that a partial revolution has been effected in the Ordnance Bureau of the Navy Department, in consequence of the failure of the attack on Charleston, and new instructions have been issued respecting the armament of the ironclads, not only of those at Port Royal but of those now building, and also respecting naval ordnance generally. "The Dahlgren guns are to be removed and an entirely new style of 13-in. gun, using 75 lb. of powder at a load, is to be substituted; this is to be done before the attack on Charleston is renewed. Fort Sumter may be effectively bombarded at a much greater distance by the new guns than by those of the Dahlgren pattern. The new guns are now in process of construction, but it is believed several weeks will elapse before they can be put into a sufficient number of 'Monitors' to permit a renewal of the attack on Charleston."

TURNBULL'S MILLS FOR GRINDING GRAIN.

The annexed engraving shows in sectional view a mill for grinding corn or other grain recently patented by Mr. J. Turnbull, of Barnard's Castle, Durham.

The invention relates to that class of mills for grinding grain known as vertical mills, that is to say, the bed or stationary stone is placed on its edge, and the grinding surface therefore in a vertical position; while the running stone is mounted on a horizontal axis, its face being brought up parallel to the face of the bed stone. The bed stone is placed to about half its thickness into a cast-iron box or case which encircles and fits it somewhat closely, and bolts fixed with lead in the stone project through the holes in the disc of the case, over which are mounted bridge pieces fixed on the case; the screw parts of the bolts pass freely through these bridge pieces and are held by nuts on each side of such bridge frames, by which means the position of the bed stone can be adjusted at will. The shaft on which the running stone is mounted passes quite through the bed stone, and is supported at that end by a bearing formed in a cast-iron boss, fitted in the eye of the stone. The boss fitted in the eye of the bed stone is cylindrical, and considerably larger than the shaft which occupies the centre, in order to receive an archimedian screw which carries the feed through the bed stone, and up to the face of the running stone. The screw is fixed on the shaft, and therefore rotates with it. The feed is delivered by a spout into a small hopper or shoot made on the back end of the boss which conducts it to that end of the screw. The cylindrical boss is bolted to the case receiving the bed stone. The hopper receiving the grain in bulk is in suitable position and has a slide to regulate the passage of the grain, which passes from thence by a spout or shoot to the boss hopper before mentioned; this shoot is fitted with a spring bottom, formed of a sheet of metal, by which the upper end is attached, it is suspended towards the other end by a rod furnished with a regulating screw and nut. Immediately below the shoot bottom is a tappet piece which projects through the stone boss as before mentioned. The tappet has two, three, or more points of contact which strike the bottom of the shoot and cause the grain to pass regularly down the shoot, whereby a regular supply of grain to the stone is insured. In order to regulate the feed, and cause it to supply more or less, the regulating screw may be raised or lowered, and so cause the tappets to strike the bottom with greater or less force. The stones are enclosed in a casing, and air vents provided as usual. The bearing on which the end of the shaft rests next to the running stone is fitted with a sliding brass, against which a screw takes, whereby it, and conseqnently the shaft and running stone, can be forced and kept up to the bed stone at a regulated distance. This journal of the shaft is furnished with one or more projecting rings, fitting into grooves in the brass, the end of which further has a raised part bearing against the end of the shaft, these together take the thrust of the screw; the standards of the shaft bearings, and also the frame of the bed stone, are mounted on a suitable foundation or flooring to keep them in proper relative position.

ON SCIENTIFIC EXPERIMENTS IN BALLOONS.

By James Glaisher, Esq., F.R.S.*

In the introductory part of the discourse, Mr. Glaisher gave a brief history of aërostation, from the discovery of the fire-balloon in the year 1782, by the two brothers Montgolfier, noticing some of the principal ascents made with fire-balloons. He then spoke of the discovery of Cavendish in 1776, viz., that hydrogen gas was fully ten times lighter than common air; when it immediately occurred to Dr. Black, of Edinburgh, that if so, a thin bladder filled with this gas ought to rise of itself; yet a period of several years elapsed before this obvious property was applied to the inflation of balloons; not, in fact, till the success of the fire-balloon was established. He then spoke of the more remarkable ascents and experiments which were made with air-balloons within a few years of its discovery, and remarked, that the result of the several experiments having proved that the balloon would raise great weights in the air, and remain for a long time thus suspended, caused a general desire to navigate the lofty regions of theatmosphere, and to pursue meteorological and other investigations in those regions, and the invention of the balloon was looked upon as likely to be followed by great consequences. He then spoke of the different ascents which have been made in the interests of science: the first of which was that of Mr. Boulton, well known as the partner of the famous Watt, who constructed a balloon to which a match and serpent were attached, that the gas might explode in the air. The object was to determine whether the reverberating sound of thunder was caused by echo or by successive explosions; the point remained unsettled owing to the shouting of the people; but it was thought that the sound did resemble thunder.

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* Read before the Royal Institution, Col. P. J. Yorke, F.R.S., in the chair.

This experiment was made on December 26, 1784. No further experiments were made, so far as he knew, till the beginning of the present century, when in the years 1803 and 1804, Mr. Robertson made three ascents from St. Petersburg, for the purpose of making magnetical and other experiments.

On August 23, 1804, MM. Gay-Lussac and Biot ascended from Paris for a similar purpose; they attained an altitude of 13,000 feet, and found no difference in their experiments in electricity, magnetism, and galvanism from those made on the earth.

On September 15, Gay-Lussac ascended alone to a height of 22,977 feet; he found that the temperature declined from 82 deg. to 15 deg.; that the sky was deep blue; that the time of horizontal vibration of a magnet was shorter with elevation.

In 1806, Carlo Brioschi, Astronomer-Royal at Naples, endeavoured to ascend higher than Gay-Lussac; the balloon burst, but its remnant happily checked the rapidity of the descent.

A period of forty-four years followed, during which no systematic attempts were made to take scientific observations by means of balloons.

In 1850, MM. Bixio and Barral inflated a balloon with hydrogen gas, in the gardens of the Observatory at Paris, with the intention of ascending to a height of from 30,000 to 40,000 feet; in their first ascent they ascended to a height of 19,000 feet, and descended to the earth in 47 minutes; they passed through a mass of cloud 9,000 feet in thickness.

In their second ascent, clouds were reached at 7,000 or 8,000 feet, which proved to be 15,000 feet in thickness; they never, in fact, passed out of the clouds; for when they were 23,000 feet high, they began to descend, owing to a rent in the balloon.

Mr. Welsh's experiments were made in the year 1852: on August 17 and 26, October 21, and November 10, the respective heights attained in these were 19,500 feet, 19,100 feet, 12,640 feet, and 22,930 feet: a great number of observations were made, from which the following law regarding the decline of temperature with elevation was deduced:—

> "That the temperature of the air decreases uniformly with the height above the earth's surface, until at a certain elevation, varying on different days, the decrease is arrested, and for a space of 2,000 or 3,000 feet the temperature remains nearly constant, or even increases by a small amount; the regular diminution being afterwards resumed and generally maintained at a rate slightly less rapid than in the lower part of the atmosphere, and commencing from a higher temperature than would have existed but for the interruption noticed."

These results, as well as those found by Gay-Lussac relative to the decline of temperature with increase of elevation, appeared to confirm the law which theory, based upon observations upon mountain sides, assigns for the gradation of temperature, viz., a decrease of one degree of temperature for every increase of 300 feet. Up to the present time, therefore, the high expectations entertained on the discovery of the balloon have never been realized.

The speaker then proceeded to state, that since the formation of the British Association, grants of money have been made for the purpose of pursuing these inquiries; but with the exception of those by Mr. Welsh, none have been made.

In the year 1861, another grant of money was made, and a committee appointed to carry out experiments by means of the balloon, and the task of making these experiments was undertaken by the speaker.

The primary objects of the experiments with which he was entrusted were:—

The determination of the temperature of the air and its hygrometrical states at different elevations up to five miles.

To compare the readings of an aneroid barometer with those of a mercurial barometer up to five miles.

To determine the electrical state of the air.

To determine the oxygenic state of the air by means of ozone papers.

To determine the time of vibration of a magnet on the earth, and at different distances from it.

To determine the temperature of the dew point by Daniell's Dew Point Hygrometer, Regnault's Condensing Hygrometer, and by the use of the Dry and Wet Bulb Thermometers as ordinarily used, and by their use when under the influence of the aspirator, so that considerable volumes of air are made to pass over their bulbs, at different elevations, as high as possible, but particularly up to those heights where man may be resident or where troops may be located, as in the high lands and plains of India, with the view of ascertaining what confidence may be placed in the use of the Dry and Wet Bulb Thermometers, by comparison with the results as found from them and with those found directly by Daniell's and Regnault's Hygrometers; and to compare the results as found from the two hygrometers together.

To collect air at different elevations.

To note the height and kind of clouds, their density and thickness at different elevations.

To determine the rate and directions of different currents in the atmosphere.

To make observations on sound.

To note atmospherical phenomena in general, and to make general observations.

The speaker then described the method of managing a balloon, spoke briefly of the several ascents already made, and then proceeded to speak of some of the results.

Speaking of the ascent on July 17, the departure of the temperature from a regular progression was very remarkable. Below the cloud the decrease was nearly uniform; on passing above it there was an increase of 6 deg.; the decrease was then resumed, and the temperature was 26 deg. at 10,000 ft. and continued at this reading till 13,000 ft. had been passed; a very remarkable increase then took place, and at 19,500 ft. a temperature of 42 deg. was registered, and then declined rapidly to 16 deg. at five miles. In descending, a disturbance from a regular increase was met with at 24,000 feet, and continued to 17,000 feet; at 13,000 feet clouds were reached, and no observations were made below 10,000 feet.

The temperature of the dew point approached that of the air in the cloud, but did not touch it, and then separated more and more until at the highest point there was almost an entire absence of moisture.

On August 18, the temperature of the air decreased as usual on leaving the ground, until at the height of 4,000 feet the rapidity of the decrease was checked, and a warm current of air was met with and continued to 11,500 feet; the balloon then descended and passed through the same warm current extending to the same limits, and again passed through it on its reascension at about the same height, and extending to 14,000 feet, when the regular diminution was resumed and continued to the highest point; on descending, the same warm current was met with, and continued till the clouds were entered at 6,500 feet, which caused another interruption in the regular increase of temperature as is usual on entering cloud.

In the ascent on September 5, on passing out of the cloud there was an increase of temperature of 9 deg.; and then no interruption was met with till a height of 15,500 feet was reached, when a warm current of air was reached, and continued to 24,000 feet: then a regular decrease was experienced till the highest point was reached. On descending, the same warm current was encountered between 22,000 and 23,000 feet; and a similar interruption, but to a greater amount, was experienced till the balloon had descended to about the same height as it was first met with on ascending. After this there was no further interruption till the descent was completed. A table was then formed from all the observations, showing the decrease of temperature for successive increases of elevation of 1,000 feet. The results are as follows:—

When the Sky was Cloudy.

	Ft.		Ft.		Deg.				Deg.		Ft.
From	0	to	1000	was	4·7	from	7	experiments, or	1	in	213
,,	1000	to	2000	was	4·2	from	7	,,	1	in	239
,,	2000	to	3000	was	4·1	from	10	,,	1	in	244
,,	3000	to	4000	was	3·7	from	10	,,	1	in	271
,,	4000	to	5000	was	3·1	from	6	,,	1	in	323

From these results it will be seen that when the sky is cloudy, the decline of temperature differs very little from the theory of a decline of temperature of 1 deg. in 300 feet.

But When the Sky is partially Clear.

	Ft.		Ft.		Deg.				Deg.		Ft.
From	0	to	1000	was	7·2	from	5	experiments, or	1	in	139
,,	1000	to	2000	was	5·3	from	5	,,	1	in	189
,,	2000	to	3000	was	4·6	from	5	,,	1	in	254
,,	3000	to	4000	was	3·4	from	6	,,	1	in	295
,,	4000	to	5000	was	2·7	from	7	,,	1	in	370

These results differ considerably from those formed in a cloudy sky, and doubtless the difference between experiments carried on under a cloudless sky would differ still more. They do not at all confirm the theory of a decline of 1 deg. of temperature in 300 feet.

The Decrease of the Temperature of the Air, at heights exceeding 5000 feet.

	Ft.		Ft.		Deg.						Ft.
From	5,000	to	6,000	was	2·8	from	10	exprimts., or	1	in	357
,,	6,000	,,	7,000	,,	2·8	,,	8	,,	1	,,	357
,,	7,000	,,	8,000	,,	2·7	,,	8	,,	1	,,	370
,,	8,000	,,	9,000	,,	2·6	,,	8	,,	1	,,	384
,,	9,000	,,	10,000	,,	2·6	,,	8	,,	1	,,	384
,,	10,000	,,	11,000	,,	2·6	,,	8	,,	1	,,	384
,,	11,000	,,	12,000	,,	2·6	,,	6	,,	1	,,	384
,,	12,000	,,	13,000	,,	2·5	,,	6	,,	1	,,	400
,,	13,000	,,	14,000	,,	2·2	,,	6	,,	1	,,	455
,,	14,000	,,	15,000	,,	2·1	,,	9	,,	1	,,	477
,,	15,000	,,	16,000	,,	2·1	,,	9	,,	1	,,	477
,,	16,000	,,	17,000	,,	1·9	,,	9	,,	1	,,	527
,,	17,000	,,	18,000	,,	1·8	,,	9	,,	1	,,	556
,,	18,000	,,	19,000	,,	1·8	,,	9	,,	1	,,	556
,,	19,000	,,	20,000	,,	1·5	,,	9	,,	1	,,	667
,,	20,000	,,	21,000	,,	1·3	,,	9	,,	1	,,	771
,,	21,000	,,	22,000	,,	1·3	,,	9	,,	1	,,	771
,,	22,000	,,	23,000	,,	1·0	,,	9	,,	1	,,	1,000
,,	23,000	,,	24,000	,,	1·3	,,	2	,,	1	,,	771
,,	24,000	,,	25,000	,,	1·1	,,	2	,,	1	,,	909
,,	25,000	,,	26,000	,,	1·0	,,	1	,,	1	,,	1,000
,,	26,000	,,	27,000	,,	1·0	,,	1	,,	1	,,	1,000
,,	27,000	,,	28,000	,,	0·9	,,	1	,,	1	,,	1,012
,,	28,000	,,	29,000	,,	0·8	,,	1	,,	1	,,	1,050

These results follow almost in sequence with those found with a partially clear sky; and together show that a change takes place of 1 deg. of temperature in 139 feet near the earth, and only in 1,000 feet at the height of 30,000 feet, and plainly indicates that the decline of 1 deg. of temperature must be abandoned.

Treating the observations for determining the degrees of humidity of the air in the same way, the following are the results:—

When the Sky was cloudy, saturation being considered as 100,

On the earth the degree of humidity was			78	from	5	expts
At height of	1,000	the degree of humidity was	76	,,	9	,,
,,	2,000	,,	77	,,	11	,,
,,	3,000	,,	75	,,	11	,,
,,	4,000	,,	80	,,	10	,,
,,	5,000	,,	81	,,	5	,,
,,	6,000	,,	82	,,	3	,,

The law of moisture here shown is an almost uniform state of humidity to the height of 3,000 feet, viz., 76·5; then a decrease on the next 1,000 feet, and an increase to 83 and 82 at 5,000 and 6,000 feet.

When the Sky was partially Cloudy,

On the ground the deg. of humidity was			63	from	4	expts
At height of	1,000	the deg. of humidity was	68	,,	5	,,
,,	2,000	,,	77	,,	5	,,
,,	3,000	,,	76	,,	5	,,
,,	4,000	,,	76	,,	7	,,
,,	5,000	,,	69	,,	6	,,
,,	6,000	,,	68	,,	6	,,

At heights exceeding 6,000 feet, the following were the results:—

	Ft.					
At height of	7,000	the deg. of humidity was	64	from	7	expts
,,	8,000	,,	58	,,	7	,,
,,	9,000	,,	52	,,	7	,,
,,	10,000	,,	82	,,	7	,,
,,	11,000	,,	48	,,	5	,,
,,	12,000	,,	48	,,	8	,,
,,	13,000	,,	43	,,	5	,,
,,	14,000	,,	58	,,	2	,,
,,	15,000	,,	53	,,	3	,,
,,	16,000	,,	45	,,	3	,,
,,	17,000	,,	33	,,	3	,,
,,	18,000	,,	21	,,	2	,,
,,	19,000	,,	36	,,	2	,,
,,	20,000	,,	33	,,	1	,,
,,	21,000	,,	12	,,	1	,,
,,	22,000	,,	31	,,	1	,,
,,	23,000	,,	16	,,	1	,,

The laws of moisture here indicate a humidity near the ground less by 15 with a partially clear sky, than in a cloudy sky; starting with 63 in the former state on the ground, increasing to 77 at 3,000 ft. high; then nearly constant to 5,000 ft., when it abruptly decreased to 69 and 68 at 5,000 and 6,000 ft., and then decreased nearly evenly at the rate of 5 in 1,000 ft., till at 9,000 ft. and 10,000 it was 52; the degree then constantly decreased till at a height exceeding 25,000 ft. it was less than 10, and it would seem that at higher elevations there was an almost entire absence of water. These seem to be the general laws; but this regular diminution is evidently often interrupted, and strata of moist air may exist, or be passing at different elevations, even up to 20,000 ft., of some thickness.

Electrical State of the Air.—In the ascent on July 17, the air was found to be charged with positive electricity, becoming less in amount with increased elevation, till at the height of 23,000 ft. the amount was too small for observation. The instrument was broken in the descent, and was not afterwards used.

Time of Vibration of a Magnet.—The general result of all the experiments is, that the magnet vibrates in a *somewhat longer interval* of time at higher elevations than on the earth. The result is contrary to that found by Guy-Lussac in 1804.

On the Propagation of Sound.—From observation made in the different ascents, it was learnt that different notes and sounds pass more readily through the air than others: for instance, the barking of a dog and the whistle of a railway engine have been heard at a height of more than two miles, whilst the shouting of several thousand people cannot be heard at the height of one mile.

On the Oxygenic Condition of the Atmosphere.—On July 17, the test papers by Moffat and Shönbein, were untinged by colour throughout the journey; and the same result was found during the ascent on July 30.

On August 10, Mr. Glaisher received a letter from Dr. Moffat, of Hawarden, expressing surprise at this result, inasmuch as it has always been received as a theory, that ozone increases in quantity with increased elevation.

In consequence of this, Mr. Glaisher went to Dr. Moffat, at Hawarden, and requested him to make some papers, which he did, and these papers were used on August 18, together with some prepared by Messrs. Negretti and Zambra, and some prepared according to Schönbein's formula; and at 22,000 ft. the colouration was 4 on a scale whose deepest tinge is 10, whilst those prepared by Schönbein were coloured to 1 on the scale, and those by Negretti and Zambra, were uncoloured; in consequence of this, the preparation of the papers by Messrs. Negretti and Zambra has been stopped.

Physiological Observations.—On July 17, before starting, the number of Mr. Coxwell's pulsations were taken, and found to be 74 in one minute; and Mr. Glaisher's were 76 in one minute.

At a height of 17,000 ft., Mr. Glaisher's had increased to 100, and Mr. Coxwell's to 84; and on reaching the ground, the number was 76 with both gentlemen.

On August 21, no observations were taken before starting. At the height of 1,000 ft., the following results were obtained:—

Mr. Coxwell	96	per minute.
Mr. Ingelow	80	,,
Capt. Percival	90	,,

At 11,000 feet—

Mr. Coxwell	90	in a minute.
Mr. Ingelow	100	,,
Capt. Percival	68	,,
Mr. Glaisher	88	,,
Master Glaisher	89	,,

At 14,000 feet—

Mr. Coxwell	94	per minute.
Mr. Glaisher	98	,,
Mr. Ingelow	112	,,
Capt. Percival	78	,,
Master Glaisher	89	,,

The pulsations of Capt. Percival were so weak that he could scarcely count them; whilst those of Mr. Coxwell he considers had increased in strength.

From these results it will be seen that diminished pressure exercises a different influence upon different individuals.

On July 17, at 19,000 ft. the hands and lips were noted as being dark-blue, not the face. At the height of four miles the palpitations of the heart were audible, and the breathing was affected.

On August 18, the hands and the face were blue at the height of 23,000 ft.

On September 5, at the height of about 29,000 ft. Mr. Glaisher became unconsious, and at 53,000 ft. Mr. Coxwell lost the use of his hands. At 29,000 ft. on descending, Mr. Glaisher began to recover, and at 25,000 ft. the observations were resumed.

The general results of these eight ascents are:—

1st. That the temperature of the air does not decrease uniformly with the height above the earth's surface, and consequently the theory of a decrease of 1 deg. of temperature for an increase of elevation of 300 ft. must be abandoned. In fact, more than 1 deg. declined in the first hundred feet when the sky was clear, and not so much as 1 deg. in 1,000 ft. a height exceeding 5 miles.

These experiments are the first to yeild any definite information on the subject; more experiments are required to settle the law satisfactorily, but its effect on the laws of refraction will be great: all the elevations of the balloon are to a certain extent erroneous, for it has never happened that the mean of the extremities has given the mean of the whole column of air.

2nd. The degree of humidity decreased wonderfully with the height, till at above 5 miles there was scarcely any aqueous vapour at all.

3rd. That an aneroid barometer can be made to read correctly, to the first place of decimals certainly, and to the second place of decimals probably, to a pressure as low as 7 inches.

4th. That a dry and wet bulb thermometer can be used effectively up to any height on the earth's surface where man may be located.

5th. That the balloon does afford a means of solving with advantage many delicate questions in physics.

J. G.

PRACTICAL HINTS FOR THE CONSTRUCTION OF LIGHTNING CONDUCTORS.

By M. Sacre.

Beginning at the upper end of the lightning conductor we have first the platina point; it generally suffices to be made 1½ in. high and ⅜ in. diameter at its base; the base of the copper cone 11-16ths in., while the iron rod is ¾ in. diameter, copper being a better conductor than iron. It is preferable to make the rod of round, rather than of square iron. The rod should increase in diameter downwards, and should consist of 6 ft. lengths, each welded together—these lengths are screwed together with 1 in. gas thread sockets. If the ground string of the conductor is to be led overground, it ought to be 11-16ths of an inch, if underground, ¾ of an inch diameter, in either case to be made of bar iron and not wire cable. The copper cone is 11-16ths of an inch diameter screwed and 1½ in. long; the iron rod adjoining is screwed similarly; but one must have a left and the other a right handed thread, joined by a corresponding screwed socket, the end of the rods abutting against each other. All the other joints to be made in the same way. The horizontal string of the conductor joined to the vertical by hard-soldering a ring welded on to the former to the latter. The ground string terminates in a cast-iron pipe filled with charcoal, and with a hermetically closed cover, screwed at the part where the conductor passes through. The end of the conductor is screwed into a metallic disc. If it is led into a well, the disc should be of cast-iron of from 6½ to 8½ sq. ft. area, resting on the bottom of the well.

If it ends in the earth, however, the end should be of a copper cylinder, of 10 to 20 sq. ft. superficial area, according to the moisture in the soil. The diffusion of the current is more effective, the larger the surface. If the ground string is made of wire cable, the end of the same should be soft soldered into a piece of iron, whose other end is screwed. A screwed socket joins the same to the ring, or other part of the conductor. The mode of joining by screwed sockets is simple and cheap and is very convenient in laying the ground string of the conductor when made of round bar iron, as recomended.—*Practical Mechanics' Journal.*

OPENING OF THE BHORE GHAUT RAILWAY INCLINE.

Such events as the celebration of the opening of the Bhore Ghaut Incline of the Great Indian Railway, present a refreshing contrast with the sad records of daily intestine strife which Indian papers but too lately presented. We hail the increased development of railway communication in our Indian dependencies as an assurance of peace and tranquillity not likely to be easily disturbed. The active part taken by the Government in the promotion of this line goes far to prove, that England at least understands that the civilization of India should be one of her first objects. Little doubt remains that to her we may in future look for the greater proportion of our cotton supply; and the success which has attended the working of the heavy inclines on this line proves, plainly enough, that there will be no difficulty whatever in supplying a means of transit by which the precious material may easily be brought to convenient shipping ports. The *Bombay Saturday Review* says:—

"The Incline reaches at one long lift the height of 1,832 ft., the highest elevation yet attained by any railway incline. It is 15¼ miles long, and its average gradient consequently 1 in 46·39. The highest gradient is 1 in 37, and the sharpest curve 15 chains radius. The tunnels are 25 in number, the greatest length of any of them being 341¼ yards. There are eight viaducts, one consisting of eight arches of 50 ft., and being 129 ft. high, and another of a like number of arches with a maximum height of 143 ft. The quantity of cutting amounts to 2,067,738 cubic yards, and of embankments to 2,452,308 cubic yards; and there are 22 bridges of various spans, and 74 culverts. The total cost of the works has been £1,000,000, or £68,750 a mile.

"The Giovi Incline is upon the Turin and Genoa Railway, and commences 7¼ miles from Genoa, a point 295 ft. above the level of the Mediterranean, and ascends the Appenines. The Semmering Incline is upon the Vienna and Trieste Railway, and crosses the Noric Alps at the pass of that name. It is replete with extensive and extraordinary works. The preliminary operations and study of this Incline occupied from 1842 to 1848, a period of six years. It was opened in May 1854, its construction having taken 5¼ years. Upon the Bhore Ghaut, about four years were spent in preliminaries, and the works have been completed in about 7¼ years from the date of their commencement. In the four months of the monsoon, during which about 150 in. of rain fell, no work could be carried on except in some of the tunnels, where the work has never ceased night or day.

"The fact last mentioned, of the completion of the works in the comparatively short period of 7¼ years, is the more remarkable, because the Incline was for a long time singularly unfortunate in its contractors. Mr. Faviell, whether through his own neglect or through a mistake in the terms of the contract, spent a great deal of money and did very little; Mr. Tredwell died within a fortnight of the time of his arrival in India; and Messrs. Adamson and Clowser had all their exertions defeated by the outbreak of cholera, which destroyed some thousands of their native workmen, and dispersed the rest. Less energetic men would have been disheartened by such a constant succession of misfortunes; but Messrs. Adamson and Clowser only pushed onward with more determined resolution, and success has at last crowned their untiring efforts."

THE SOUTH ESSEX WATERWORKS.

A NUMBER of gentlemen connected with science and art and sanitary interests assembled together on Saturday last at Grays, Essex, to witness the interesting ceremony of the opening of the South Essex Waterworks. The purpose of the Company, of which Mr. Alfred Smee, F.R.S., is the chairman, is, in the first place, to supply the towns and villages of South Essex with water, and subsequently to make the water available for any deficiency that should occur in any part of London.

The chalk pits of Grays, where the works are erected, are situate about a mile from the Thames; they cover an area of nearly 60 acres, and are filled with water springs, which are so prolific, and are perpetually rising in such large volumes, as to produce a million of gallons per day.

The Company have now completed their high-service works, and have laid on the water to Brentwood and Warley; in the course of time an abundant supply of water will be furnished to the towns in the upper part of the county, and ultimately to the eastern suburbs of London. At present five pumps are employed, and the quantity of water obtained every 24 hours is 2,100,000 gallons.

The following is a description of the pumping apparatus, &c., from particulars furnished to us by Messrs. Easton and Amos, the engineers to the works. The steam-engine employed for raising the water from the chalk-pit to the reservoir at Warley, is constructed upon the principle known as Woolf's double cylinder, and is the most economical and convenient agent that can be employed for this purpose. The steam is first used at high-pressure in the small cylinder, where it is allowed to exert its full power throughout the entire stroke; from this it passes into a larger cylinder four times the capacity of the small one, so that it is then expanded to four times its first bulk, and, consequently, its final pressure is reduced in a like proportion; it then passes into the condenser beneath the cylinders, where it is again converted into water, and in this process a vacuum is formed which draws down the piston on the large cylinder, and then the whole power of the steam is made available. The water is raised by a pump, which is worked by a rod direct from the wrought-iron beam of the engine. The pump is double-acting, having both a bucket and plunger, and thus represents a combination of the common lift pump, with a force pump similar to that used for feeding boilers. The bucket is twice the area of the plunger, and the consequence of this is—that it draws at the up stroke the full contents of the barrel, but only discharges one-half into the delivery pipe, the other half being displaced by the plunger at the down stroke. This causes a pretty uniform flow of water, and enables it to be forced, with the assistance of a large air-vessel, straight into the main, without the intervention of a stand-pipe. It is believed that this is the only instance of water being raised to a height of 400 ft. through a main 9¼ miles in length.

With regard to the source of the water, it issues from the chalk formation out of vertical fissures which have been formed by some upheaving of the strata, and which takes one general direction. To obtain water, all that is to be done is to cut across these fissures, each of which is separate from the other.

Owing to the operations which have taken place in working these chalk pits, very little tunnelling is required. The tunnel in use at present is 25 ft. long and 5 ft. broad, and this can be extended to indefinite proportions according to requirement.

The origin of this company was somewhat singular. Mr. Meeson, the owner of the property, having worked out the chalk to the level of the springs, attempted to go deeper, but was stopped by an immense influx of water. Engines were then erected, the power of which was gradually increased until 10,000,000 gallons of water were daily pumped into the Thames. At this point Mr. Meeson advertised for engineering assistance; the advertisement was answered by Messrs. Easton and Amos; and thus in due course, that which originated in accident, has been turned to practical account and for the benefit of the public.

GAS WORKS IN GERMANY.

THERE are in Germany 266 gas works, of which 66 are worked by townships or individuals, and 200 belong to various companies.

The combustible employed is chiefly coal, the largest quantity being supplied from England. Out of 7½ million quintals, 3,350,000 are obtained from the English collieries. Berlin, which produces annually 800 million cubic feet of gas, uses about half of this quantity of coal. Hamburg takes more than 500,000 quintals, and the rest is used in the gas works of Altona, Lubeck, Rostock, Stralsund, Stettin, Dantzic, Konigsberg, &c. The excellent quality of the English coal for gas-making causes the preference to be given to it over indigenous coal; but if the cost of transport of the latter can be cheapened, it is thought that it will ere long come into use in Hamburg, Berlin, and other towns.

The following are the percentage proportions in which the various coal is used in Germany:—

English coal	46.00
Westphalia	18.00
Moravia	11.50
Zwickan	7.50
Saarbuck	7.00
Silesia	5.00
Dresden	2.25
Bohemia	2.00
Northern Bavaria	0.75
	100.

Besides the gas works which consume coal, Germany possesses 20 in which wood alone is employed for distillation; and there are two small works in Holstein which consume peat or turf at certain times, and at others coal.

The retorts used are generally of clay, except in those works where gas is made from wood. The total number of retorts employed is estimated at 7,337, made for the most part in the immediate locality of the works; their form and size differs considerably.

Assuming that the mean consumption of gas in the 24 hours is 25 millions of cubic feet, and supposing that each retort furnishes daily 4,500 cubic feet, it follows that these 7,337 retorts must be continually, or three-fourths of the time, in work.

The use of extractors is much less general than would be supposed. There are only 90, or less than a third of the whole of the gas works in Germany which employ about 107 extractors. The small works do not employ them at all.

The meters in general use are water-meters of native manufacture, and may number about 139,000. The mean number of lights of each is about eight.—*Journal de l'Eclairage au Gaz.*

Meetings for the Week.

TUES.—*Royal Inst.*—"On Sound," by Prof. Tyndall, at 3 p.m.
Royal Inst.—"On Geology," by Prof. D. T. Ansted, at 3 p.m.
THURS.—*Antiquaries.*—At 8.30 p.m.
FRI.—*Royal Inst.*—"An Account of some Researches on Radiant Heat," at 8 p.m.
Architectural Assoc.—Nomination of Officers. "Rochester and its Cathedral," by C. North. Illustrated by Drawings.
SAT.—*Royal Soc.*—"On Electric Telegraphy," by Prof. W. Thompson, at 3 p.m.

Miscellanea.

A prospectus has been issued of the Crystal Palace and South London Junction Railway, an extension of the London, Chatham, and Dover line by Peckham to the Crystal Palace. The capital is to be £675,000, in shares of £10, of which one-half are to carry a 6 per cent. preference. The station at the Crystal Palace will be on a level with the floor of the building.

A prospectus has been issued of the Copenhagen Railway Company, with a capital of £160,000, in shares of £10. The object is to carry out some concessions granted by the Government for the construction of lines of railway to be worked by horses only, from the centre of the capital to the most frequented parts of the suburbs. The aggregate length of the lines to be first made is ten miles, at a cost of £4,500 per mile.

We are glad to find that upwards of £300,000 have been subscribed to the Atlantic Telegraph Company. Letters of allotment were issued on Tuesday last by the directors.

The preliminary announcement has been made of a new project, bearing the title of the Cape Race Electric Telegraph and Lightship Company (Limited). It is intended to construct, equip, and station a steam lightship off Cape Race, Newfoundland, in the track of steam and and sailing ships bound to and from the North American Colonies and the northern ports of the United States. The lightship will have telegraphic communication with the shore by means of a submarine cable, one end of which is to be worked on board the vessel. It is urged that by these means there may be obviated throughout one-half of every year an unnecessary delay of three days, which now occurs in the receipt and exchange of news between Europe and America. Various other useful services are to be rendered, with the aid of a steam tender. The capital proposed is £100,000.

Les Mondes says:—A bank-note printed in blue, on a yellow ground, is the only one which photography cannot reproduce with success.

We learn, from experiments conducted at Brest by M. Le Guen, that castings containing a small per centage of wolfram, are far superior to those of the ordinary kind; the principal advantage conferred being increased elasticity.

Dr. Walter Lewis, the medical officer of the London Post-office, states in his report just issued that he has arrived at these conclusions from observations of the health of the travelling officers of the Post-office,—That railway travelling has little, if any, injurious effect on the healthy, strong, well-built persons, if the amount be not excessive and if they take moderate care of themselves; but that persons who take to habitual railway travelling after the age of 25 or 30 are more easily affected than those who begin earlier, and that the more advanced in age a traveller is the more easily is he affected by this sort of locomotion. Weak, tall, loosely-knit persons, and those suffering under various affections, more especially of the head, heart, and lungs, are very unsuited for habitual railway travelling.

In Perth, on Sunday last, a new lamplighting apparatus was used, consisting of a small lamp covered with gauze work, which is attached to the end of a stick of sufficient length to enable the man to turn the stop-cock, and so light the gas. The plan wrought admirably, and a considerable saving of time was effected, even on the first night of trial.

The official Admiralty designs, prepared under the direction of Mr. Reed, for the re-construction of the wooden frigate "Belvidera," 51, as an armour-plated frigate, have been received at Chatham dockyard, and are now being copied to scale, preparatory to the vessel being taken down and re-constructed under No. 7 shed, where preparations are making for commencing the work as soon as a sufficient number of hands are released from the other vessels now in progress. The statement that the "Belvidera" is to be converted into an armour-plated frigate, according to the plans of Mr. Laing, the master-shipbuilder at Chatham, is not strictly correct. Although he prepared designs for the new vessel, they were not acted upon by the Admiralty. The "Belvidera," as well as the whole of the five armour-plated frigates ordered to be built in accordance with the recent decision of the House of Commons, are to be constructed from the designs prepared by Mr. Reed.

A prospectus as been issued of the Photogenic Gas Company for the purpose of introducing the, patent of M. Mongruel, which is alleged to produce either from ordinary gas or from atmospheric air, a light more powerful, cheap, and healthy than any hitherto known. The proposed capital is £200,000 (of which one-half is to be first put forth) in shares of £20. The price to be paid for the patent is £5,000 in cash and £45,000 in shares.

A prospectus has been issued of the Dunaburg and Witepsk Railway, with a capital of £2,600,000 in shares of £100. The length is to be 161 miles, to connect Dunaburg, the terminus of the Riga and Dunaburg line, with Witepsk, and thus bring forward the produce of a rich agricultural district. A contract for its construction has been made with Messrs. Peto and Betts, for a total of £2,143,615, and as the Russian Government guarantee 5 per cent on £2,600,000—namely, £130,000, per annum—while the amount requsite to be called up on the shares will thus be only £33, a revenue of 6 per cent. will be yielded.

A NOVEL STEAMER.—The screw-steamer "Nautilus," Captain Wintringham, which arrived at Hull on Wednesday morning from St. Petersburg, brought a small tubular cigar-shaped steamship, which was built about two years ago by a gentleman named Winan. This novel steamer, which is built on the same principle as the American tubular vessel, drawings of which appeared in the *Illustrated London News* about two years ago, has been brought to this country for the purpose of experimenting upon. She is at present 80 ft. long, and in the widest part amidships is 8 ft. in diameter. We understand, however, that she is to be considerably enlarged, and for that purpose will be handed over to Messrs. Earl and Co., shipbuilders of Hull. The owner is confident that, after she is lengthened, and other improvements made, she could cross the Atlantic with perfect safety, and would answer admirably for an American mail boat. On the top or back of the vessel there are four short tubes projecting about two-and-a-half feet, which will answer the purpose of ventilators, and as a means of entrance to the vessel. To prevent the steamer rolling over in the water, she is well ballasted with spelter, and draws about 3 ft. of water. There are several screws in her sides to which stanchions may be fastened. On this a grating to form a deck is fixed, and an iron guard runs from stem to stern. The vessel is propelled by means of a screw, which is placed about 20 ft. from the stern. She is fitted with a rudder at each end.

The British Navy in 1677.—A correspondent of the *Standard* writes:—I send you a list of all our navy in the year 1677, taken from a manuscript book written for the private use of King Charles II., it being the only record of the navy of that period (see "James' Naval History," vol. I., pp. 8 and 537), which is in my possession.

Rates.		No. of Guns.
1st	9	878
2nd	17	1,406
3rd	42	2,834
4th	40	1,890
5th	17	408
6th	10	132
SMALL VESSELS.		
Yachts	17	116
Sloops	13	52
Hulks	6	—
Hoys	4	—
Smacks	5	—
Total	180	

Novel American Cartridge.—Powder and ball in contact are together made up in an exceedingly thin envelope of india-rubber, which effectually protects the powder from damp; by this means the use of paper is rendered unnecessary, and the time required for loading reduced to the lowest possible limit. It is said that the French Government have taken the adoption of the invention under consideration.

The Log Supeseded.—An experiment has just been made on the Seine, at Paris, with an instrument called a *lochometre*, for measuring the speed of vessels. This instrument, which is intended to supersede the log now in use, is composed of a metal syphon, of which the extremities are immersed in the water. A small screw is fitted to the top and to the interior of the instrument, on which the water acts as soon as the ship or boat moves, by constantly entering one end of the syphon and running out at the other. Some clockwork is attached to the screw, the functions of which are to mark on a dial-plate by hands the distance in yards performed by the vessel, commencing with one unit, and extending to hundreds of miles. The experiment was tried on board the steamboat "Parisien," which carries passengers between Paris and St. Cloud. The distance was accurately marked on the dial-plate by the movement of the hands.

The Anchors and Chain Cables Bill.—At the monthly meeting of the Liverpool Chamber of Commerce on Monday, it was agreed to petition in favour of Mr. Laird's bill for regulating the tests of anchors and chain cables according to the provisions made by the Admiralty.

The Manufacture of Great Guns.—We are waiting anxiously as to some report upon the qualities of the 23-ton 600-pounder. This gun, as our readers may remember, is rifled on a modification of the shunt principle, its elongated projectiles being furnished with buttons, similar to those on one of the 300-pound shot fired against Messrs. Brown's thick plates at Shoeburyness. We are the more anxious to have some report about this 600-pounder, as the endurance of heavy guns firing rifle projectiles with large charges has not been satisfactory; but we believe that Sir William Armstrong is able to fire the round ball also of his modified shunt-rifled piece. Respecting our old acquaintance, the Horsfall gun, we are also desirous to hear something, and trust that its early reappearance at Shoeburyness will put to silence all doubts as to the healthy condition of a very fine forging. The guns now being prepared by the Ordnance Select Committee for the trial of the system of rifling previously described by us are to be built up round steel tubes toughened by immersion in hot oil, on the plan introduced by Mr. Anderson, who, since Sir William Armstrong's resignation, has had the entire direction of the work in the gun factories at Woolwich. This talented and practical mechanic has lately, we understand, submitted a plan for making field-guns in three or four pieces only, which will materially reduce both labour and cost, at the same time that it will greatly increase the endurance of the gun, and render it less liable to damage from the rough usage of war.—*Army and Navy Gazette.*

New Pier, Holyhead.—On Monday, a new stone pier, nearly 500 yards long, extending through the large area under Tan-y-ran from the railway station to the old pier, was commenced. The London and North-Western Railway have contracted with Messrs. J. and C. Rigby, of Royal Victoria Harbour, Holyhead; and we understand that the whole works will cost at least £250,000.

Photolectric Engraving.—Mr. Duncan C. Dallas, of 102, Fleet-street, has invented a process which, though imperfect at present, has considerable and obvious benefits. Mr. Dallas proposes to obtain from a clear photograph an engraving possessing a softness, detail, and a peculiar vigour of its own. Printing ink, which, when really good, is beautiful and free from a greyish colour after years of wear, is to be used for this purpose. We have before us a couple of specimens from Mr. Dallas's process—which have not been touched by the engraver—and which possess a peculiar soft and delicate tone. We shall trace the progress of this new branch of the photographic art with interest, as it bids fair to become of considerable utility.

The International Exhibition Buildings.—A supplementary Civil Service estimate was published on Monday last, showing that a vote of £172,000 is to be asked for the "purchase of land and purchase and alteration of buildings used for the purposes of the late International Exhibition." The following are the particulars of the vote:—

—	Total Estimate for the Service.	Vote Required for 1863-4.	Further Amt that may be Required.
	£	£	£
For the purchase of land and certain buildings from Her Majesty's Commissioners for the Exhibition of 1851 ...	120,000	67,000	53,000
For the purchase of existing Exhibition buildings from the contractors	80,000	80,000	—
For repairing, altering, and eventually completing the building.	284,000	25,000	259,000
Total	484,000	172,000	312,000

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisments.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

Received.—G. S.—G. A. D.—J. A. and Sons.—J. H.—Com. S.—Dr. W.—J. P.—W. W.—Capt. N.—B. Bros.—S. and Co.

Thos. Walker (Birmingham).—The information you refer to was derived, as far as Mr. Hall's engine is concerned, from a statement made in a book edited by Mr. Scott Burn. Professor Rankine obtained nearly similar results from the engine of the "Thetis." Messrs. Rowan or Messrs. Randolf and Elder might possibly supply you with what you require.

D. H.—Two patents were taken out in 1858 for weighing cranes, but we are unable to say if either is the property of the Kirkstall Forge Company. One was granted to E. Moss, and numbered 193; the other to J. O. Butler, No. 2029.

D. Smith.—1. When a patent is abandoned, the invention is open to the public, provided there is not another patent of prior date for the same thing. Any person is at liberty to patent improvements upon inventions, the patents for which have been abandoned. 2. "A communication" means that the invention has been communicated from *abroad* to the party in whose name the patent is taken. Inventions of persons resident in this country cannot be patented in the name of another party. 3. We cannot reply positively to your inquiry about eyelets.

To the Editor of the "Mechanics' Magazine."

Sir,—Perhaps you or some of your correspondents could kindly inform me of the best mode of welding domes for steam boilers, I mean the cylindrical parts. I find considerable difficulty in obtaining a heat sufficient for the purpose without burning the iron.

Birkenhead. A Boiler Maker.

[The method usually adopted in the best practice in such cases is as follows:—The plate having been bent to a rough approach to the cylindrical form, so that the edges approximate, is heated in the centre of its length, and being placed when removed from the fire, on a suitable mandril, has about four inches of the joint welded first, not a lap joint but one, technically known as a "butt," being the best. The welding then proceeds in successive heats from the centre towards each end. Care being taken to commence striking where the last weld finished. As to regulating the heat, we know of no better plan than that of placing a quantity of ordinary forge scale within the tube on the seam; this scale will bear a very high heat without becoming red-hot. When the iron has reached the proper welding heat, the scale just begins to melt, the test is regarded as infallible by old boiler-makers. We have seldom seen it fail.]—Ed. M. M.

To the Editor of the "Mechanics' Magazine."

Sir,—Will you please favour me, through the Mechanics' Magazine, how I can pour the mercury into a bent tube for a barometer? The difficulty to me is how to obtain a vacuum in the upper part of the tube, which is closed. An answer through your valuable paper will much oblige your obedient servant, G. A. T.

Wisbeach, June 3rd, 1863.

[The vacuum may be obtained by pouring a small quantity of mercury into the tube first, and boiling it. While boiling, the lamp is to be withdrawn, and the open end plunged into a vessel full of mercury, when, if the process has been properly conducted, the tube will fill to the top, provided it is not more than 30 inches higher than the level of the mercury into which the open end is plunged. The mercury should then be carefully boiled for a few minutes. The process is altogether one of considerable nicety, and requires some skill.]—Ed. M. M.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 2956, 2963, 2985.
Boilers and Furnaces, 2994.
Ships and Boats, including their fittings, 2950.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 2948, 2989, 2990.
Cultivation of the Soil, including agricultural implements and machines—*none.*
Food and Beverages, including apparatus for preparing food for men and animals, 2959.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 2947, 2951, 2955, 2971, 2972, 2977, 2978, 2981, 2984, 2995, 2998.
Buildings and Building Materials, 2973.
Lighting, Heating, and Ventilating, 2961, 2966.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 2953, 2954, 2957, 2958, 2965, 2968, 2969, 2970, 2974, 2975, 2980, 2983, 2993.
Metals, including apparatus for their manufacture, 2960, 2962, 2964, 2988, 2996.
Chemistry and Photography, 2997.
Electrical Apparatus, 2986, 2992.
Warfare, 2949, 2979.
Letter-Press Printing—*none.*
Miscellaneous, 2952, 2967, 2976, 2982, 2987, 2991.

2947. H. Williams and J. Maxton: *Improvements in machinery or apparatus employed in the manufacture of lace, or trimmings made on bobbin net or twist lace machines.* Dated October 31, 1862.

This invention consists in the employment of wheels, cut or constructed in such manner as to enable us to work either five or more warp threads, with one back warp thread and two bobbin threads. *Patent abandoned.*

2948. F. Gibson, T. Hall, and T. Davison. *Improvements in railway breaks.* Dated October 31, 1862.

This invention relates to several peculiar combinations of self-acting mechanism for applying railway breaks when the speed of the engine is checked, the consequent overrunning or crowding of the carriages in the train, and the inward movement of the several draw-bars, causing the application of the breaks to any or all the carriages or waggons in the train. According to one arrangement the breaks are fitted on to arms attached to a transverse rocking shaft, which rocking shaft is provided near the middle with a lever arm having a sliding piece thereon. This sliding piece is kept extended, so as to lengthen the arm by means of a spring or otherwise, but is held up when the break is not in action by the tail of a suspended lever or equivalent device acted upon by the draw-bar. Immediately beneath the end of the sliding piece on the lever there is a boss or collar made on the axle, and a notch or projection formed thereon. So long as the tractive strain of the engine acts upon the draw-bars and keeps them drawn out, the sliding pieces will be held up clear of the bosses or collars, but the moment the steam is shut off, and the speed of the engine is checked, the draw-bars run in and, by moving the tail of the suspended levers or equivalent device in the several carriages, allow the sliding pieces to descend and drop into the notch, or in front of the projection on the bosses, and being caught by them as they rotate, cause the lever and rocking shaft to be partially turned, and to apply the breaks. When the speed of the engine is increased again, the extension of the draw-bars lifts the sliding pieces and takes off the breaks again by the aid of a spring for that purpose. The bosses or collars above referred to may, if found desirable, form part of the nave or hub of the wheel, in place of being a separate boss on the axle. *Patent completed.*

2949. W. E. Newton. *Improvements applicable to the carriages and beds of guns, mortars, and other ordnance.* (A communication.) Dated October 31, 1862.

The nature of this invention consists in the use of india rubber for, and its application to, the trunnions of mortars, guns, or ordnance around them as bearings, and before and behind the carriages of mortars, guns, or ordnance on their beds, to resist the force of the recoil and reaction in firing. Also in the application and use of india rubber above and below, and before and behind, the beds of mortars, to resist the force of the recoil and reaction in firing. Also in the mode or method of checking the gun at the furthest limit of its recoil. And, lastly, in the use and application of an eccentric ring enclosing the india rubber round the trunnions of mortars. *Patent completed.*

2950. F. E. Sickels. *Improvements in steering and manœuvring ships or boats, and in apparatus connected therewith, which apparatus is also applicable for pumping or lifting weights.* Dated October 31, 1862.

This invention consists in improvements upon that kind of steering apparatus in which steam or other fluid under pressure is employed for the purpose of actuating the rudder, the object being to ensure increased efficiency and security in steering and manœuvring vessels. The apparatus for working the steering gear is also applicable for various other purposes, such as for pumping or lifting weights. When any great degree of rapidity in turning and manœuvring steam vessels is required, a forced draught to the furnaces (to increase the propelling power) should be combined with ample mechanical power to operate a large rudder. The steering engine is made to disconnect from the steering apparatus, and to connect with a hoisting drum, thus saving the room occupied by a separate hoisting engine for loading and unloading the vessel. When fresh water is required, an apparatus can be used to condense the steam that operates the steering apparatus, thus obtaining fresh water for the ship's company. If the steering apparatus be placed below the steam boiler which supplies it with power, a trap or other mechanism should be used to discharge the condensed water, either into tanks or overboard. To ensure the use of the least possible power required to operate the steering apparatus, the valve or valves which admit the steam or other fluid under pressure to the working cylinders is or are so connected with the steering apparatus that, while the steersman, by turning the wheel, opens the valve to admit steam to the cylinders, so as to cause the rudder to move, the steering apparatus, in moving, will give this same valve or valves a closing motion, and thus modify the extent of the opening of the valve and the rapidity of the admission of the steam or other fluid to the working cylinders. The power to move or hold the rudder is transmitted through an adjustable friction or connection, so as to limit the power transmitted from or to the rudder. *Patent completed.*

2951. J. G. Marshall. *Improvements in the treatment of straw of flax, hemp, and other similar substances preparatory to spinning the fibre thereof.* Dated October 31, 1862.

The patentee claims treating the straw of flax, hemp, and other analogous vegetable substances by the processes described, whereby retting, scutching, swingling, and heckling may be dispensed with. *Patent completed.*

2952. W. Jenkins. *An improved mode of, and apparatus for, cutting coal.* Dated October 31, 1862.

In performing this invention, the patentee saws or cuts the coal out in blocks of convenient size. In carrying out this part of the invention, supposing he commences at an angle that has been prepared for the purpose, he first drills one or more holes in the upper or other convenient part of one of the faces of the coal near the roof of the mine, in order to make an opening for the introduction of the saw or cutting instrument, with which he proceeds to cut down into the coal in a vertical or diagonal line from top to bottom. He then drills one or more holes in the other face of the coal, and at right angles to the former cut, and proceeds to cut down in a vertical or diagonal line from top to bottom as before. By this means a pillar of coal from 12 in. to 18 in. square, according to the desired size, will be divided from the seam, except at the top and bottom, from which, if desired, it may be easily detached by a lever, if it does not fall away by its own weight; or if desired, a saw-cut in a horizontal direction may be made to facilitate the removal of the block of coal from the bed or seam. In order to cut out the coal on this improved plan, he arranges the operations systematically, so as to be enabled to actuate by mechanical power the machines employed for the purposes of the invention. *Patent completed.*

2953. J. J. Anderson. *A new or improved mode and means for the production of leather from waste leather scraps in combination with india rubber, gutta percha, or other light substance, and new material to be used as leather and for other purposes.* Dated October 31, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2954. W. Tarr. *An improvement in pianofortes.* Dated November 1, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2955. J. W. Taylor. *Improvements in scouring or cleaning woollen, worsted, and cotton fabrics and other fibrous materials, and in the means or apparatus employed therein.* Dated November 1, 1862.

The fabrics or other fibrous materials to be scoured or cleaned are, as they pass from the wash liquor, conducted between a pair or pairs of rollers, covered with prepared india rubber, by which such rollers will effect an elastic pressure. The fabric or other fibrous material is by pressure conducted open, first, alternately through wash fluid, and between these rollers, until the dirt or other matter to be removed has been well loosened; and then the patentee forces clean water in streams or jets on to the fabric, or other fibrous material, and again passes it between such elastic pressure rollers, by which the scouring or cleansing will be fully effected. *Patent completed.*

2956. E. Field, M. Merryweather, and R. Merryweather. *Improvements in steam fire-engines, parts of which improvements are applicable also to other purposes.* Dated November 1, 1862.

This invention consists of a framed carriage mounted—when intended for land surface—on travelling wheels. At the hinder end of the frame is the boiler, in front of which is placed the steam cylinder and pump. The boiler consists of a vertical fire-box, with water and steam chamber above, from the lower plate of which descend a number of tubes, arranged around the entrance to the smoke-flue, the lower ends of some of them converging inwards to bring them into more immediate contact with the main body of the fire. Within these tubes are smaller ones, open at top and bottom, their upper ends being wide-mouthed or trumpet-shaped to facilitate the entrance and downward passage of currents of solid water, unaffected by the steam which rises externally around them. The exhaust pipe from the steam cylinder, on entering the chimney, passes downward to a chamber (the lower surface of which forms a baffle plate), whence the steam is projected upwards to increase the draught in the fire-box. Provision is made for cushioning the piston in the steam cylinder by causing it to pass beyond and close the main ports, the steam and exhaust being then led through a smaller channel capable of nice adjustment. Steam is admitted to the working cylinder of the engine by a slide valve acted upon by a smaller steam valve, which receives its motion from connecting rods attached to the piston rod of the engine. *Patent completed.*

2957. G. Haseltine. *Improvements in burial cases.* (A communication.) Dated November 1, 1862.

The patentee claims—1, Controlling, disinfecting, and deodorizing the gases as they escape from the coffin, by making holes or valves therein, and combining and confining with or over the said holes or valves the disinfecting or deodorizing material in some part of the coffin, which is to be otherwise air-tight. 2. Making a chamber, in combination with the coffin, for the purpose of holding the deodorizing and disinfecting material, and causing the gases to pass through the said chamber on their way out of the coffin. 3. The use of the valve in combination with the disinfecting and deodorizing chamber. *Patent completed.*

2958. E. Stevens. *Improvements in iron shelves, stands, and racks.* Dated November 1, 1862.

In constructing iron stands composed of a series of shelves one above the other, each shelf is supported by ornamental cast-iron brackets, at suitable distances apart from each other, which are either to be fixed to a wall, or they may be carried by cast-iron pillars or standards. These brackets stand out from the column or wall, and their outer ends are connected at the front of the stand to eight iron columns by screws or otherwise. At the foot of each column is a screw-thread, on to which a hollow globe or other suitable foot is screwed; this foot serves to regulate the height of the column, and also facilitates the fastening the stand to the floor. Across the top of such bracket grooves are formed at a suitable distance apart, to receive T-iron, the strips of T-iron being by preference to run the whole length of the shelves. The T-iron is received into the grooves, so that the top of the T-iron is level with the top of the brackets, and the strips of T-iron are held in their places by pieces of wrought-iron plate screwed on to the top of the bracket. *Patent completed.*

2959. W. E. Newton. *Improved apparatus for drying grain and other substances.* (A communication.) Dated November 1, 1862.

This invention consists in the combination of a series of sieves or grated platforms arranged one above another, and inclined in opposite directions within a tower or shaft, and an elevating apparatus by which the grain or other substance to be dried is carried up to the top of the tower or shaft to be deposited on the uppermost screen, or platform, or sieve. The sieves or platforms have imparted to them a shaking motion, by which the grain or other substance is caused to be distributed over and to run down the sieves or platforms from each to the one below it, while upward currents of air generally heated are caused to circulate in the tower or shaft, and through the sieves or platforms, and to absorb the moisture and carry it off at the top of the tower or shaft. From the lowest sieve or platform the grain or other substance is delivered into a suitable receptacle, whence it may be carried away to bins or other places; or, if not properly dried, may be taken and carried up again to the top of the tower or shaft to have the process repeated. *Patent completed.*

2960. E. Hopkins. *An improved method of, and apparatus for, treating ores, and for the extraction of metals therefrom.* Dated November 1, 1862.

The chief object of this invention is to effect by an economical mechanical process (the details of which process we cannot produce here) the separation of gold from its ores to such an extent that, when the ore is submitted to furnace heat to complete the separation of the gold, it will be presented in the form of a rich auriferous powder. *Patent abandoned.*

2961. J. Winter. *An improved safety tap or cock, applicable to gas burners, gas pipes, and vessels containing gas. Also water pipes, steam pipes, and vessels containing inflammable and other liquids, compressed air, and spiritous liquids.* Dated November 1, 1862.

This safety tap or cock is constructed as follows:—Through a square or other shaped piece of metal, the patentee forms two taper holes, in one of which he fits an ordinary plug or tap, and in the other a plug or valve, somewhat similar to an ordinary plug, but differing therefrom by making the outer end thereof or handle round instead of flat, and milling the edge thereof, so that, in order to turn this valve round in its seat, the milled part must be firmly gripped by the nippers. There is a spring attached to the valve for turning the same in its seat, and a spring bolt for holding the valve open, the said bolt being acted upon by the ordinary tap aforesaid. The essential feature of this invention consists in connecting the ordinary tap before mentioned with the valve aforesaid, or, in other words, in causing the tap when shut off to act upon the valve, thereby withdrawing the bolt and allowing the spring to turn the valve in its seat, and shut the passage through same, so that, in the event of the handle of the ordinary tap aforesaid being accidentally turned round, the valve aforesaid will remain closed until it is turned round by hand, as above stated. By the use of this self-acting valve, the escape of gas, compressed air, or other fluid or liquid, will be prevented, and security against accidents from explosion or fire and waste most effectually ensured. *Patent completed.*

2962. F. Tussaud. *Improvements in machines for cutting metals; also applicable to cutting other substances.* Dated November 3, 1862.

This invention consists in an improved construction or arrangement of circular metal cutting machines, by which sheets of metal, cardboard, leather, and other materials of great width and length, may be divided continuously, and curved or round shapes may be cut out, and is as follows:—For cutting in the middle of sheets of metal or other material, the ordinary circular cutters, having their edges bevelled or not as required, and slightly crossing each other, as usual, are mounted at the extremity of two long shafts or axles, suitably supported, the length of the axles varying according to the length of the sheet to be cut. A way or groove is formed in the framework of the machine for the passage of the cut metal or other material, so that, with a machine of small dimensions, large sheets of metal or other material may be divided in the middle. For cutting curved forms of small or large radius, the upper cutter is vertical, and is worked by the motive power; the axles of the lower cutter are independent of the mover, and are articulated so as to be adjustable at any angle to the upper cutter. *Patent completed.*

2963. J. Musgrave. *Improvements in the valves of steam hammers, and steam hydraulic and gas engines.* Dated November 3, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2964. C. Shield. *Improvements in the manufacture of malleable cast iron.* Dated November 3, 1862.

This invention consists in manufacturing malleable cast iron by injecting atmospheric air into or upon raw or crude metal (iron) in a molten state. *Patent abandoned.*

2965. L. Gonez. *A seat or chair forming also a travelling bag for the use of travellers by rail or other way.* Dated November 3, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2966. F. Trachsel and T. Clayton. *Improvements in machinery or apparatus for obtaining light, heat, and ventilation, parts of which improvements are also applicable to other purposes.* Dated November 3, 1862.

This invention has reference to a former patent dated March 15, 1861, No. 652. We cannot give space to the voluminous details of the invention. *Patent completed.*

2967. G. Hollins. *Improvements in the manufacture of straps and belts for machinery.* Dated November 3, 1862.

This invention consists in an improved mode of joining the single straps together. Instead of stitching them the entire length, the inventor stitches them at the joints only, and secures the intervening spaces by rivets, thereby rendering the double strap more pliable than those at present in use, and effecting a great economy of labour. *Patent abandoned.*

2968. E. Humphrys. *Improvements in the construction of centrifugal pumps.* Dated November 3, 1862.

This invention consists in casting the case in two pieces, the joint being made in a line passing horizontally through the axis of the wheel spindle and its stuffing-box and in casting the wheel and its spindle in one piece. In this manner the use of covers is avoided, the fitting is simple and easily accomplished, and in consequence of the line of the joint passing through the axis of the wheel spindle, the wheel is readily introduced or removed when necessary, the upper part of the case being unbolted and lifted for the purpose. *Patent completed.*

2969. W. Clark. *Improvements in castors and in the manufacture of the same.* (A communication.) Dated November 3, 1862.

In carrying out this invention the inventor makes the socket, which is fitted on the leg or other part supporting the furniture, with a bottom or disc disposed about or below the middle of its depth, and from the centre of such disc he raises a socket tube, which receives a pin or axis fixed in the plate, having the arms in which the roller or castor is fitted. This plate fits in the bottom of the leg socket, so as to turn freely therein. Between this bottom plate and the false bottom or disc of the leg socket before mentioned, he disposes a series of friction rollers, which transmit the weight of the furniture to the plate and arms carrying the wheel. These friction rollers are mounted on a sort of star-piece or series of radial arms, fitted on the centre pin of the castor, each arm forming an axis for one of the friction rollers. The leg socket is fixed in the ordinary manner, while the tube or socket receiving the centre pin passes to a greater or less length up the centre of the leg, and may or may not be used for further fixing the castor on the leg or furniture. By thus fitting the parts of the castor, it will move round easily, although under great pressure, and adapt itself readily to the direction it is desired to travel. The castor wheel may also be disposed more immediately underneath the table leg or other point of support. *Patent completed.*

2970. T. O. Clark. *An improved portable spring bottom bedstead.* (A communication.) Dated November 3, 1862.

In carrying out this invention, the inventor constructs the framework of the improved portable spring bedstead by preference of iron (it may be cast iron), with the side rails hinge-jointed to the ends of the bedstead, as also in the middle of their length, and so that they fold inwards—that is to say, the side rails fold or double, and may assume a position in a direction across and parallel, or nearly so, to the ends of the bedstead, which at the same time approach each other to within, say about 8 in. or 10 in. of each other in its collapsed form. The side rails are fitted with notches to receive the laths or stretchers suppporting the bed. These can be readily placed or removed from position; when in position they keep the frame rigid. From the laths or cross rails he supports the mattrass surface by a peculiar arrangement of springs distributed throughout the area of the bedstead, the lower parts being connected to the rails, and the other parts to longitudinal and cross webbings at the points of intersection thereof. We cannot here quote all the details. *Patent completed.*

2971. D. Scattergood. *Improvements in circular frames for the manufacture of looped fabrics.* Dated November 3, 1862.

This invention consists of certain arrangements of machinery in circular frames or "roundabouts," as they are termed in the trade, as hereinafter described, whereby shirts, drawers, hose, and other articles made thereon may be "fashioned" or "narrowed" in order to impart the desired shape to such articles without their being cut, and the parts united to form the "fashion," and whereby such narrowed goods are finished as far as the fashion is concerned before being removed from the same. The heads of the frames may be mounted to work in a vertical, horizontal, or inclined position, as desired. In order to produce the fashion, a certain number of needle plates or carriers with their needles are removed from the circle of needles, yet the same space between every two needles in the circle is preserved, while the needle-plates or carriers have constantly a bearing or support at back upon a hollow conical collar and conical supports, which are moved to present a circle of decreased diameter when needle-plates and needles are moved, and which are again moved in a contrary direction to afford bearings of increased diameter when the needles are replaced. The usual loop and dividing, landing, and knocking-over wheels are moved to perform their functions, whatever be the diameter of the circle of needle. *Patent completed.*

2972. P. F. C. Chevron and E. C. Eichenberg. *An apparatus for weaving India shawls and other figured tissues.* Dated November 3, 1862.

The object of this invention is a new method of manufacturing India shawls, carpets, and other descriptions of figured fabrics. The inventors accomplish this by producing by machinery the hooking "crochetage" which has hitherto been done in India by hand. For this purpose they dispense with a shuttle, and substitute for it needles and hooks, the combined action of which, facilitated by the play of supplementary weighted cords, and by a comb, the teeth of which are free at the top, produce the fabric. *Patent completed.*

2973. R. A. Brooman. *Improvements in machinery for moulding and compressing artificial fuel, peat, bricks, tiles, and other substances.* (A communication.) Dated November 3, 1862.

This invention consists in constructing and arranging, moulding and pressing, machinery as hereinafter described. Upon a bed the inventor erects a pillar for carrying the axis of an oscillating beam. To this beam, in front of the pillar, two pistons are connected, one at the end of the beam and the other near the pillar. One piston is used to compress and mould the substances in moulds carried on a revolving platform, and the other for driving the moulded or compressed substances out from the moulds. Where the shape of the moulds will not admit of the moulded articles being driven down through them, then he employs a piston from below to force them up through the moulds. This latter piston is made to move up and down by levers connected to the beam behind the pillar through a connecting rod. The revolving platform carries several moulds, and is made to revolve to present the articles, first to the moulding piston, and then to the piston for driving out the moulded articles. Motion is communicated to the outer edge of the platform, which is toothed for the purpose, through a paul and lever worked from the same prime mover, which, through a connecting rod, drives the oscillating beam. The moulded articles are carried away upon an endless belt. *Patent completed.*

2974. W. H. Stallard. *Improvements in umbrellas and parasols.* Dated November 3, 1862.

This invention consists of a novel mode of constructing umbrellas and parasols, whereby the same are combined with a walking stick, so that when shut up the stick forms the umbrella case. The peculiarity of this invention is that the stick upon which the umbrella is opened also forms the case in which it is contained. This hollow stick or shaft is closed at one end with a ferrule, and at the other end fitted with a handle, which opens upon a hinge, and is fastened and secured when closed by a lock snap and spring knob, or by a rotary collar with a groove or slot, or by any other suitable means. The umbrella frame and cover is made without any shaft or stick of its own, and thus folds when collapsed in a very small compass, and occupies a much smaller space than when constructed in the usual way with a centre shaft and runners. *Patent completed.*

2975. J. B. Francis. *Improvements in apparatus for raising and lowering window blinds, maps, and other articles for retaining them in position.* Dated November 4, 1862.

In Venetian blinds, maps, and other articles, it is customary to convey the cords by which they are raised and lowered over guide pulleys mounted on a fixed stud. This invention consists in mounting the said guide pulleys in a lever jointed to a box or frame; the cords after passing over the guide pulleys pass between the tail end of the levers and the inside of the box or frame; to the tail end of the lever is also attached a check cord. After the blind, map, or other article has been raised to the required height, it is retained in position by the weight thereof binding the cords between the tail end of the levers and the frame. In lowering the blind, map, or other article, the check cord has to be depressed to allow the cords to pass between the tail ends of the levers and the frame. *Patent abandoned.*

2976. J. Lefebvre. *Clitograph or instruments for indicating angles or variations of level, and for measuring horizontal and vertical distances.* Dated November 4, 1862.

In carrying this invention into practice, the patentee proposes to call the instrument made in accordance with the invention a "clitographe." Such instrument consists of a frame, which he prefers to make in iron, or other metal, by preference of a parallelogram shape. The frame has suspended from the centre of its upper side a pendulous arm or radial bar, to which a spirit level is attached at about the centre of its length, and so mounted as to be readily capable of adjustment and rectification; a line should be drawn vertically along the centre of the pedulous arm. At the lower part of the frame there may be either one, two, or more sectors on which there is engraved at the centre of their length a zero point, and the angles are marked right and left thereon, either as tangents or degrees and minutes, so that all angles, abscisses, and ordinates can be readily read off. The pendulous arm or radial bar may have a lip or guide-piece at its lower end working over the bottom sector, so that it may be kept in position or up to its work, this lip may form a vernier scale. *Patent completed.*

2977. F. Durand. *An improved cotton gin.* Dated November 4, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2978. J. McKean and T. Greenall. *Improvements in sizing or dressing yarns or textile materials.* Dated November 4, 1862.

This invention relates to the application or employment and use of a novel compound or composition for the purpose of sizing or dressing and preparing warp yarns for the loom or for sizing. The basis of this compound or composition is what is technically or commercially known as China clay, kaolin, or other similar siliceous or aluminous earths, and such clays are rendered available for use in the treatment of warp yarns by admixture with the products obtained from farinaceous or amylaceous matters, such as wheat, rice, potatoes, sago, tapioca, salop, or from any other available or practical source, after having been subjected to certain special processes. *Patent completed.*

2979. J. H. Johnson. *Improvements in hanging, arranging, and operating ordnance.* (A communication.) Dated November 4, 1862.

The essential feature of this invention consists in hanging or arranging any number of pieces of ordnance upon a suitable frame, revolving in a vertical plane, either by the aid of steam power, or otherwise, in such manner that the guns themselves with the frame shall travel through a portion of the whole circumference of a circle. This frame is further capable of revolving in a horizontal plane, both of which revolutions may be effected separately or together. *Patent completed.*

2980. T. Logan. *An improved kaleidoscope.* Dated November 4, 1862.

This invention consists, principally, in mounting the kaleidoscope on a stand in which it is supported with the eye-piece upwards, so as to be capable of revolving. Also in attaching a circular or other reflector to the said stand, mounted on pivots so as to be capable of being placed at a suitable angle to reflect the light into the kaleidoscope. *Patent abandoned.*

2981. J. Place. *Certain improvements in looms for weaving.* Dated November 4, 1862.

This invention relates to that part of the power loom known as the "treading motion," by which the rise and fall of the healds are effected. The improvements consist in the novel improvement and use of a double set of "treddles;" that is, one set hinged to the back rail of the loom, and projecting forwards, and the other set of a corresponding number hinged to the front rail, their ends projecting towards the others, so that such extremities may be coupled together by a link near the middle of the depth of the loom. The treddles so constructed are to be actuated by "tappets," of a suitable and peculiar form, and of less dimensions than those hitherto similarly employed, and so calculated as to render the "shedding" motion more positive. By this combination of small tappets and double treddles, looms may be driven at a higher speed, and a considerable improvement effected in the fabric. *Patent completed.*

2982. P. W. Reuter. *Improvements in dyeing.* (A communication.) Dated November 4, 1862.

In carrying out this invention, the inventor takes slacked lime in the proportion of 1 lb. to every 100 gallons of water, or thereabouts, and after the same has been well mixed, he takes the clear solution of lime and adds thereto powdered oxide of lead, litharge, minium or massicote, or other salt or compound of lead, in the proportion of about 2 oz. to every lb. of wool or woollen fabric to be dyed. He then adds carbonate of soda in the proportion of about 1 oz. to every lb. of wool or woollen fabric to be operated upon. Having thus formed the bath or mixture intended for the dyeing or colouring of wool or woven fabrics thereof, he proceeds as follows:—The mixture or bath being contained in a suitable vessel, he places therein the wool or fabric to be dyed, and he gradually raises the temperature of the mixture or bath to 150 deg. Fahrenheit, and after the wool or other material or fabric to be dyed has attained the desired intensity of colour or tint, he removes it from the dye bath. It may then be removed and dried, but generally it is preferred to subject it to what is known as a "soap bath," and afterwards to a bath containing water acidulated with hydrochloric or other suitable acid; and, finally, to several washings in cold water, as is well understood. By this means, any lime or other substance which may become attached to the wool in the process of dyeing is removed. *Patent completed.*

2983. T. Huntley. *Improvements in kitcheners and kitchen ranges, and in cooking and bath-heating apparatus.* Dated November 4, 1862.

In carrying out this invention, the patentee, first, forms the whole of the parts which fit together, and which are usually fastened with screws and other similar media, with male and female flanges, or tongue of groove or lap-over joints. This improved form of joint gives strength to the plates by the flanges. Ranges thus constructed can be made more readily, and can be more easily put up and removed when required, than as heretofore constructed. Greater facility is also afforded for repairs, and the liability to breakage, consequent upon the corrosion of all screw fastenings, is avoided. Secondly, he forms the fire grate, flues, and dampers, and so constructs and places the ovens and other parts of the apparatus, that the products of combustion from the fuel in the grates are converted into a clear heat, free or nearly so from smoke, and which heat or product of more perfect combustion, is concentrated upon any part of, or entirely disseminated through, the apparatus, thus economizing the fuel necessary to produce the required degree of heat, while the less quantity of smoke passing through the flue prevents the usual accumulation of soot and the coating of the surfaces of the parts of the apparatus therewith, whereby the draft is impeded, the effective action of the heat is diminished, and the operation of the apparatus retarded. Thirdly, he dispenses, where the service is constant, with the necessity for any house tank or intermediate feed cisterns, and all kinds of water vessels (hot or otherwise), together with the usual complicated mechanism for bath-heating, by the substitution of an improved construction of steam and water boilers, which together with the other parts of the improved apparatus (except the supply and service pipes) are all adapted to and contained in the fire-place or chimney opening. *Patent completed.*

2984. R. A. Brooman. *Improvements in the manufacture of fringes, and in machinery employed therein.* (A communication.) Dated November 4, 1862.

This invention consists in manufacturing fringes by machinery, and in certain arrangements of machinery hereafter described, whereby hand labour is dispensed with in the manufacture of fringes. The inventor employs a frame with shafts, cams, and toothed gear, for imparting the necessary motions to the various parts of the machine. He employs a disc or frame for carrying bobbins of silk, worsted, or other material of which the fringe is to be formed, and imparts rotary and stop motions thereto for allowing of the threads from the different bobbins being wound off at the proper moment. The threads may be of different colours; and in addition to them, he uses a warp thread. The machine being set in motion, the disc with its bobbins turns upon its axis as well as a guide through which the threads from the bobbins pass to a hook, which, seizing hold of the thread, recedes with it and doubles it, in the length required for the bullion or twist, allowance being made for the shortening consequent upon the twisting. At this part of the operation, a presser comes upon and tightens the work previously made. The doubling hook delivers the thread doubled to a twisting hook, which partakes of rapid rotary motion, which motion is interrupted twice by means of a tappet. The first interruption is to allow of the rotating hook taking the thread from the doubling hook, and the second to allow of the bullion or twisted fringe being unhooked from it. This unhooking is effected by nippers, which transmit the fringe between a drum and rails, an endless belt facilitating the advance of the finished fringe. During these operations the bobbin disc has performed part of a revolution, and has presented a bobbin with thread of a different colour, to be acted upon by the doubling hook and other parts, as before described. *Patent completed.*

2985. J. Shirt. *Improvements in apparatus for condensing the steam of high-pressure steam engines.* Dated November 4, 1862.

For the purposes of this invention an air-tight chest or vessel is applied to the exhaust pipe of a high-pressure steam engine; above the point where the exhaust pipe is applied to the chest or vessel, there is a perforated partition, or other provision is made for dividing the condensing water into numerous streams. The condensing water is introduced by a pipe at the upper part of the chest or vessel from a cistern or otherwise, so as to keep up a constant supply, which may be regulated by a cock or valve. From the lower part of the chest or vessel, a waste water pipe descends, and the lower end of such pipe is constantly covered with water in a well or cistern or other vessel. The exhaust steam flows from the steam engine into the air-tight chest or vessel, and is there condensed, whilst the steam in the engine acts on the piston, which, on the other side is subject to a partial vacuum. *Patent completed.*

2986. J. E. F. Ludeke. *Improvements in magneto-electric apparatus for obtaining and applying motive power.* Dated November 4, 1862.

One form of apparatus, according to this invention, consists of a square foundation plate, having four vertical standards supporting a table, from the under part of which is suspended, by means of two rods, a double bar of brass, between which a series of permanent horseshoe-magnets of five or other number are clamped and held firmly in an inverted position by means of nuts and screws. A corresponding double brass bar of smaller dimensions serves to clamp in like manner a similar series or number of flat iron needles or pointers, the points of the needles standing vertically uppermost, and the lower part or flat head forming the armatures for the magnets. This double bar is suspended by rods, and moves either on a pivot, knife edge, or hinge. In the centre of the table is suspended a pendulum, the rod of which is formed like a double fork, the prongs of which pass on each side of the magnets, and at the needles and at the central part of this fork the metal is enlarged to allow of a horizontal pivot being inserted, which passes through the centre of the double bars of the magnets, the pendulum itself reaching almost to the foundation plate. On each side of this pendulum are arranged pillars, on which are supported bell-crank levers, which give motion and alternate vibration to the pendulum by means of descending levers from the bell cranks, which are provided at their lower part with small friction wheels to act against the surface of the pendulum. The extremity of the horizontal arms of the bell-crank levers pass one in front and the other behind the pendulum, and there is attached to each a wire or cord ascending to the bars of the needles, and secured thereto one on each side by means of a stud or projection. Thus, it will be evident that, as the pendulum vibrates from side to side, together with the magnets, the needles will be magnetized by the north and south poles of the magnets alternately passing under them, by which the needles will be attracted and drawn alternately towards the north or south pole (the apparatus standing in a direction to allow of the line of magnets lying due east and west). This alternate rocking motion of the needles and their double bar actuates the studs on each side thereof, and consequently draws each cord or wire alternately upwards, whereby the descending arm of each bell-crank lever is simultaneously forced against the side of the pendulum, thereby producing a continuous motion. of the apparatus. *Patent abandoned.*

2987. A. E. Davies. *An improved lubricator.* Dated November 4, 1862.

In carrying out this invention, the patentee take a glass or other vessel of any convenient, and, if desired, ornamental shape—for example, a glass phial—and into the neck thereof he fits a stopper of cork, or other suitable material, air-tight. Through this stopper passes a small metal tube, open at one end and closed at the other end. He punctures the closed end at its centre with a fine point, and on the side of said tube, at a short distance from the aforesaid stopper, forms another fine hole. He then proceeds to withdraw the said stopper with its attached tube, and nearly fills the phial with the lubricating fluid, which should be very limpid. He then inserts the stopper aforesaid, taking care to place the punctured end of the tube thereof within the phial, leaving the open end of the said tube outermost. Having done this, he inverts the phial, the object of which will be that the air contained in the uppermost part of the phial will force out the lubricating matter through the hole in the side of the tube, the lubricating matter passing out at the open end of the tube. Now, supposing this open end of the tube to be placed over the journal of an axle, shaft, spindle, or other rubbing surface, as the same rotates or reciprocates, the effect will be to aspire the lubricating matter from the vessel containing the same, and thereby cause a partial vacuum in the said vessel, so that, when the axle or other rubbing surface is not rotating or reciprocating, the lubricating matter will be kept up within the tube by capillary attraction, and, as the axle or other rubbing surface again rotates or reciprocates, a portion of atmospheric air will pass up the tube aforesaid through the punctured end thereof into the upper part of the glass vessel, and again displace a proportionate quantity of the lubricating matter, and so on successively, thereby only discharging the lubricating matter during the rotations or reciprocations of the axle or other rubbing surfaces, and preventing the escape and waste of the lubricating matter when the axle is at rest; and it is this peculiar principle of construction which constitutes this invention. *Patent completed.*

2989. J. B. Thomas. *Improvements in apparatus for working and controlling railway signal discs.* Dated November 5, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

2990. S. Robotham. *Improvements in carriage bodies.* Dated November 5, 1862.

This invention relates to carriage bodies, and has for its object an improved manufacture of the back and arms part thereof, or the part forming the back and arms of the body. For the purposes of this invention, the inventor constructs a framework or outline of the desired shape, and similar to the construction hitherto used for the support of japanned leather and other materials, and this framework or outline he fills in with ductile sheet metal. He takes plain, perforated, or embossed sheet metal. If plain, he cuts a blank and shapes it on a block, pressing it or beating it into form. He then finishes it by hammering or otherwise. Heat may be applied to anneal or facilitate the manipulation. *Patent abandoned.*

2991. J. Banwell. *Improvements in apparatus for punching by means of hydraulic pressure.* Dated November 5, 1862.

This improved apparatus consists in applying to a suitable ordinary jaw or holder a hydraulic cylinder, with ram working therein, the outer end or front of which ram has the punch affixed thereto. This ram is hollowed out, and the hollow part is provided with a piston which can slide on a piston rod, the piston being screwed so as to act in the hollowed part of the ram, which is also screwed to correspond. By these means the inventor advances the piston, and the ram is thereby advanced by the hydraulic pressure in the cylinder resulting from this action. The punch in front of the ram is thus put to work, and acts upon the metal or material placed in the jaw or holder. The end of the hydraulic cylinder at back of the piston is to be secured by being screwed into the same, and to have an orifice for the piston rod to work through. The piston rod is moved by a lever hand or driving wheel. *Patent abandoned.*

2992. W. Johnson. *Improvements in the arrangement and construction of pillars or standards for supporting telegraph wires.* (A communication.) Dated November 5, 1862.

This invention relates to the arrangement and construction of the pillars used for supporting the wires of electric telegraphs. Under one modification, the standard consists of a cast or wrought iron pillar and socket, the lower part of which is formed with three radially projecting feathers, extending from the bottom up to the part which projects above the ground. The base is formed in this manner in order that the pillar may be fairly held in the ground when the earth is properly rammed in between the flanges. That portion of the pillar which fits into the socket and extends above the earth, may be either of a cylindrical, cruciform, angular, or polygonal figure in its cross-section. At the upper extremity of the pillar is fitted a cross-head, having two or other number of radially-projecting arms, in which are carried the insulators for insulating the telegraph wires; one of these insulators is also, if required, fitted in the centre of the cross-head. On the under side of the cross-head lugs are cast, and each lug is perforated to admit of connecting thereto a wire or rod, which is carried down to a corresponding lug in the socket at the foot of the pillar immediately above the earth. These stays or guy rods serve to stiffen the pillar, and give it the necessary strength to resist lateral pressure. Another arrangement of the socket consists of a foot-plate made with radial arms, from which extend in an upward direction stays supporting a disc, arranged a little above the surface of the earth. The telegraph pillar is passed down through a suitable aperture in the disc, and stepped into the foot-plate, and the stays or guy rods are fastened to hooks projecting out from the periphery of the disc. *Patent abandoned.*

2993. R. A. Brooman. *Improvements in commodes or water-closets.* (A communication.) Dated November 5, 1862.

This invention applies to portable as well as fixed closets, and consists in the arrangements of parts hereafter described. At the back or side of the basin is a water cistern; at the bottom of this cistern there is a cylinder, forming a pump barrel, and in this barrel a piston with valves, opening only when the piston is raised, is fitted. The outlet from this barrel is into a pipe opening into the basin. A rod is connected to this piston, and carries a handle which passes through the cover of the cistern. Two studs are fixed in the piston rod, between which the forked ends of a bent lever are placed; the other end of this bent lever is connected through a link and connecting rod to a shaft, on which the valve at the bottom of the basin is fixed. On raising the piston rod, this valve is opened, and at the same time water passes through the valves in the piston and below it. On releasing the piston, and allowing it to descend by its own weight, or assisting its descent by pressure, the valve in the bottom of the basin is closed, and the water under the basin is sent by it into the basin. *Patent completed.*

2994. R. A. Brooman. *Improvements in taps or cocks.* (A communication.) Dated November 5, 1862.

This invention consists in constructing taps and cocks as hereafter explained. A flexible diaphragm is secured in the flanges of a cap, with a solid disc of metal or other hard material fixed in the upper part thereof; a partition rises inside the tap, and forms part of the seat for the diaphragm when pressed down on the mouth of the inlet to prevent the passage of liquid. Pressure is exerted upon the diaphragm through the metal disc by an eccentric or cam pivotted on and working through the cap; the eccentric is fitted to the end of a hand lever; or a cam or heart block may be fitted to the lever of a float; or the diaphragm may be depressed by a screw; or a weighted beam may be used to press upon a rod in contact with the disc. In order to allow of liquid passing through the tap, pressure must be removed from the disc and diaphragm, when the liquid will raise the diaphragm off its seat, and, following it up, will pass over the partition in the tap and flow out. By using a circular bar with apertures, and fixing the lever carrying the eccentric in one or other of the apertures, the quantity of liquid flowing through the tap may be regulated. For water posts the pressure may be removed from the diaphragm by raising a handle fixed in a rod working through a nut. *Patent completed.*

2995. R. A. Brooman. *Improvements in spinning frames.* (A communication.) Dated November 5, 1862.

This invention consists in imparting to every separate spindle, or to every two spindles coupled in continuous spinning frames, up and down motions, whereby, for any purpose required, every such spindle or pair of coupled spindles may be stopped or taken out of work, and again returned into work without interfering with, or stopping the motion of, the rest or of any other portion of the spindles in the frame. *Patent completed.*

2996. J. C. Shield. *Improvements in the manufacture of malleable cast iron.* Dated November 5, 1862.

This invention consists in the manufacture of malleable cast iron by passing, in suitable quantity, on to or through raw or crude iron, partially refined or refined iron, when in the molten state, a current or currents of atmospheric air or steam, or of air and steam, or any other decarbonizing gas; the steam being either superheated or otherwise, and the air or other decarbonizing gas at any temperature. When the decarbonization is pushed beyond the limit desired, he adds in proper quantity, to the mass thus obtained, crude or raw iron, partially refined or refined iron, or any substance suitable for imparting a fit proportion of carbon. *Patent completed.*

2997. A. V. Newton. *A new process of obtaining printing surfaces, dies, and substitutes for photographic negatives.* (A communication.) Dated November 5, 1862.

The principal feature in this invention consists in first making a drawing in ink, which is soluble in water, upon the surface of a plate of glass or any other hard substance which has been previously coated with an alcoholic solution of shellac; then covering the whole surface with a coating of bees-wax, or of a composition of bees-wax, asphaltum, and linseed oil, or other menstruum; next, immersing the plate in water for some time, and afterwards exposing its face to the action of a stream of water, by which the latter coating is washed off only from the lines of the drawing, and the whole of the drawing itself is washed away, leaving the latter coating between and among the lines of the drawing. The plate in this condition can be used in the same manner as a wood engraving to obtain an electrotype for printing, and with very little subsequent preparation for the other purposes specified. *Patent completed.*

2998. J. Petriel and J. Teal. *Improvements in machinery or apparatus for washing wool and other fibrous materials.* Dated November 5, 1862.

This invention is not described apart from the drawings. *Patent completed.*

2999. S. Tragheim. *Improvements in treating hemp, preparatory to its being spun.* Dated November 5, 1862.

This invention consists in a mode of treating hemp in order to manufacture therefrom a substitute for cotton and wool. For this purpose the hemp is subjected to the various processes after mentioned. The inventor takes a quantity of hemp, and places it in a suitable vessel, to the bottom of which is brought a steam pipe, and the hemp is saturated with steam till it is softened sufficiently for the next process. The softened hemp is then hackled, till the fibres split up into numerous parts. The hemp is hackled to the same extent as when it is wanted to be used as yarn, as heretofore. The product is next subjected to the operation of the machine used in cotton manufactories, and known by the names of a "devil," by which the hemp will be torn up, and lose the appearance of hemp. The product is soaked in water which has been prepared in the following manner:—A quantity of chloride of lime is put at the bottom of a vessel, and lukewarm water poured on to it. The chloride of lime is not stirred, but after the water has remained for an hour or two it is run off and applied in a suitable vessel to the hemp. The hemp is to remain in this liquid until it is well saturated; it is then taken out and washed in cold water, and then dried. The product is next to be subjected to the bleaching process like yarn, and dried. The product is then passed through a carding engine, and comes out a substance which, if the hemp used has been Riga hemp, is similar to cotton; and, if it has been St. Petersburg hemp that has been used, it resembles a mixture of cotton and wool. The nature of the product in each case will depend on the class of hemp employed. *Patent abandoned.*

3000. D. Hill. *Improvements in apparatus for stamping or marking and counting bank notes and other documents.* Dated October 5, 1862.

For the purpose of this invention, two counting apparatus are combined with a stamping or marking press, and they are both actuated each time the press is actuated to produce an impression. One counting apparatus is accessible to the user of the press, or to another person, in order that such counting apparatus may be set at zero at the commencement of the use of the press on one of the several bundles or quantities of bank notes or other documents, whilst the other counting apparatus is enclosed, and is only set at zero at the commencement of a day's work or other regulated period. The arrangement of the stamping or marking press may be varied; and such is the case in respect to the two counting apparatus combined therewith; and separately, no claim is made to their construction. *Patent abandoned.*

3001. J. J. Laveissiere. *Improvements in the manufacture of tubes of copper or other metals or alloys.* Dated October 5, 1862.

This invention relates to the process of manufacturing tubes from hollow ingots or cylinders of the metal or alloy. In order to obtain a sound hollow ingot or cylinder of the metal or alloy, the patentee runs into a mould of the shape required for the exterior of the ingot the requisite quantity of the melted metal or alloy, it being either poured in at the top or run in at the side, and as soon as the metal or alloy has nearly, but not completely set, a mandril is forced down into the metal. This is effected by means of a screw or otherwise; the mandril is not, however, forced quite to the bottom of the mould, so that one end of the ingot will be closed; or it may be made with an internal flange only at its end. The metal is thus compressed, and the volume displaced by the mandril is caused to rise up around the core and to fill the mould. As soon as the metal or alloy has sufficiently set to retain its shape, the mandril is raised from the mould. In order to draw out the hollow ingots into tubes, he employs a system which allows of the metal being worked hot or cold. *Patent completed.*

3002. T. Brown. *Improvements in machinery for surfacing fibrous materials.* (A communication.) Dated November 5, 1862.

The inventor claims the use of a metallic apron, in combination with heating and cooling surfaces, to carry and apply surfacing material to, and dry the same on, a sheet of fibres, so as to surface the same, as explained. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated April 2, 1863.

845. W. H. Phillips, Nunhead, Surrey, engineer. Improvements in means or apparatus for cleaning the bottoms of ships or other floating vessels.

Dated April 20, 1863.

981. C. Blanc, civil engineer, 8, Rue Chapon, Paris. Improvements in apparatus for the purpose of using air and steam as motive power.

983. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in lamps. (A communication.)

Dated April 22, 1863.

1005. J. Lee, weaving master, and E. Dawson, foreman mechanic, Tammerfors, Finland. Improvements in looms for weaving.

Dated April 24, 1863.

1021. P. Passavant, Bradford, York. Improvements in the manufacture of blue colouring matter, and also of violet colouring matter. (A communication.)

Dated April 25, 1863.

1035. L. A. J. Bruet, Paris, clockmaker. Improvements in apparatus for registering, indicating, and verifying the time and distance passed over by vehicles, also applicable to machinery and other similar purposes.

Dated April 27, 1863.

1057. A. Rollason, East Peckham, Surrey, chemist. Improvements in dyeing and staining fabrics, parts of which improvements are also applicable for dyeing, staining, and ornamenting glass and other substances.

Dated May 5, 1863.

1121. F. Applegate, Bradford-on-Avon, woollen manufacturer. Improvements in stopping and starting railway trains.

Dated May 6, 1863.

1137. A. V. Newton, 66, Chancery-lane, mechanical draughtsman. Improvements in sewing machines. (A communication.)

Dated May 7, 1863.

1139. J. Snider, jun., Dorset-street, merchant. Improvements in breech-loading firearms and ordnance.

1141. J. Walker, Crompstall-bridge, near Stockport, Chester, mechanic. Improvements in the construction of mechanism applicable to looms, and partly to carding engines and other machinery.

1145. J. Bettridge, Birmingham, Warwick, manufacturer. Improvements in the ornamentation of papier maché and other japanned wares, wood, ivory, and other similar materials.

1147. J. B. P. A. Thierry, engineer, 91, Rue des Marais, St. Martin, Paris. Improvements in the arrangement and construction of furnaces to render the combustion of the fuel more complete, and to prevent the emission of smoke therefrom.

Dated May 8, 1863.

1149. P. J. Livsey, Manchester, consulting engineer and patent agent. Improvements in compound engines. (A communication.)

1153. C. L. Braithwaite, Kendal, Westmoreland, manufacturer, and J. Hirst, manager. Improvements in machinery for feeding slivers of wool and other material to carding engines.

1155. J. C. Droop, tool manufacturer, Schwelm, Prussia. An instrument or holder for holding nails, screws, or other fastenings.

1159. G. T. Bousfield, Loughborough-park, Brixton. Improvements in steam engines. (A communication.)

Dated May 9, 1863.

1160. W. Thomson, Coatbridge, Glasgow, locomotive engineer. Improvements in obtaining motive power, which improvements are applicable in part for raising or forcing fluids into steam boilers, tanks, and other vessels.

1161. J. Strickland, 25½, Gee-street, St. Luke. Improvements in laying veneers on to surfaces, in applying the glue for that purpose, and in the apparatus employed.

1165. J. Page, Birmingham, manufacturer, and A. T. Wayne, tool maker. An improvement or improvements in the manufacture of pens.

1166. J. Brierley, Denby Dale, near Huddersfield, dyer. Improvements in dyeing knickerbocker yarns and textile fabrics manufactured of or from such yarns.

1167. W. Boaler, 85, Piccadilly, Manchester, merchant. An improver dryer fabric for paper-making.

1171. J. B. Wood, Vernon House, Camp-street, Broughton, near Manchester, M.D. Improvements applicable to the defending of ships or vessels and forts when armour-plating is employed.

1173. C. H. G. Williams, Burnford-street, Glasgow. Improvements in the manufacture of colouring matters.

Dated May 11, 1863.

1177. B. Hargreaves, Arden House, near Accrington, Lancaster, gentleman. Improvements in tiles for drainage or sanatory purposes.

1179. C. Shorrock, manufacturer, and W. Shorrock, manager, Over Darwen, Lancaster. Certain improvements in power looms for weaving.

1183. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in coupling and disconnecting carriages on railways, and in machinery employed therein. (A communication.)

1184. J. S. Guirette, Paris, doctor of medicine. An improvement in inhaling-apparatuses.

1186. J. E. McConnell, Dean's-yard, Westminster, civil engineer, and G. H. Bovill, Durnsford Lodge, near Wandsworth, civil engineer. Improvements in chains for cables and other purposes.

Dated May 12, 1863.

1187. B. Lilly, Birmingham, brass founder. Improvements in the construction of "snap-caps" or "nipple protectors" for firearms.

1189. T. Warren, Glasgow, glass bottle manufacturer. Improvements in glass and other furnaces and kilns.

1191. J. E. McConnell, Dean's-yard, Westminster, civil engineer, and G. H. Bovill, Durnsford Lodge, near Wandsworth, civil engineer. Improvements in treating worn-out railway tyres.

1193. G. A. Huddart, Brynkir, Carnarvon, gentleman. Improved apparatus for cutting slate.

1195. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in spring mattresses. (A communication.)

Dated May 13, 1863.

1199. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in laying submarine telegraph cables. (A communication.)

1201. T. Parkinson, Blackburn, Lancaster, engineer, and F. Taylor, foreman. Improvements in machinery for weaving, sizing, dressing, and dyeing.

1203. J. E. McConnell, Dean's-yard, Westminster, civil engineer, and G. H. Bovill, Durnsford Lodge, near Wandsworth, civil engineer. Improvements in the manufacture of thick plates of wrought iron for armour plates and other purposes.

1205. C. L. Kensner, East Greenwich. Improvements in the manufacture of hydrate of barytes, and in the manufacture of sugar.

1207. A. G. Southby, Bulford, Wilts, engineer. Improvements in railway roof lamps, station, signal, and other fountain lamps.

1208. J. Farmer, Salford, Lancaster, machine maker. Improvements in calendering, embossing, and other such machines used for finishing woven fabrics, part of which improvements is also applicable to drying machines.

1209. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the extraction of hydro-carburets from minerals, in the distillation thereof, and in apparatus employed therein. (A communication.)

Dated May 14, 1863.

1211. J. Satchwell, W. H. Ashford, and C. Harrison, Birmingham, factors. Improvements in nails or rivets for boots and shoes, applicable to other purposes.

1213. J. T. King, Liverpool, patent agent. Improvements in wicks for oil and other fluid burning lamps. (A communication.)

1215. G. Dowler, Birmingham, manufacturer. An improvement or improvements in match boxes.

1217. F. K. Erlam, Devonshire-terrace, Fulham-road. A new lubricating material or compound.

1219. I. Parker, Houghton-street, Clare-market. Improvements in connecting and securing door and other knobs or handles to their spindles.

Dated May 15, 1863.

1220. B. Shillito, engineer, and D. Moor, merchant, 51, High-street, Kingston-upon-Hull. Improvements in generating heat and motive power.

1221. D. M. Fyfe, Maidenhead, Berks, Adjutant of the 19th Regiment of Berks Volunteers. Improvements in the brushes, instruments, or apparatus employed for painting the centres and bulls'-eyes of military or other targets.

1222. D. M. Fyfe, Maidenhead, Berks, Adjutant of the 19th Regiment of Berks Volunteers. Improvements in the means or apparatus employed for raising, removing, transporting, and refixing military and other targets or mantlets.

1223. W. Clark, 53, Chancery-lane, engineer and patent agent. Improvements in repeating firearms.. (A communication.

1224. A. Macmillan, 17, King's-road, Ball's Pond-road, Islington, tailor and clothier. Improvements in buttons, and in fastening buttons to garments.

1227. J. Papin, shoemaker, C. Lintz, and L. Lavacherie, 28, Rue Feydeau, Paris. Improvements in the manufacture of boots and shoes.

Dated May 16, 1863.

1230. J. Hinks, Birmingham, manufacturer. Improvements in lamps.

1232. F. M. Burns, Chorlton-upon-Medlock, Lancaster. Improvements in preventing the fouling of the bottoms and sides of ships and vessels, particularly applicable to ships and vessels constructed of or sheathed with iron.

1233. W. Clark, 53, Chancery-lane, engineer and patent agent. Improvements in rotary engines. (A communication.)

1234. J. T. Newton, Ystalyfera, near Swansea. Improvements in machinery for planishing and rolling sheet metal.

1235. J. Gibbs, Abingdon-street, Westminster. Improvements in preparing and spinning flax and other vegetable fibres and filaments, and in machinery employed therein.

1236. W. White, Leicester, manager. Improvements in machinery or apparatus for the manufacture of looped fabrics.

1238. E. B. Wilson, 5, Parliament-street, Westminster, engineer. Improvements in the manufacture of iron and other metals, and in the apparatus employed therein; parts of which are applicable for other purposes where high temperatures are employed.

Dated May 18, 1863.

1240. E. Christmas, Watford, Hertford, coach builder. Improvements in carriages for common roads.

1242. H. Bennett, Wombridge Iron Works, Salop, ironmaster. Improved apparatus or mechanism to be used for facilitating the puddling of iron.

1246. S. Toy, Birmingham, engineer. Improvements in machinery for making screw rivets, nails, or pins.

Dated May 19, 1863.

1252. F. Fenton, Mappleton, Derby. Improvements in the treatment of certain vegetable fibres for the preparation of textile materials therefrom.

1256. A. Parker. Billericay, Essex. An improved apparatus for saving from destruction by fire persons and property in houses, buildings, and ships, and also for ventilating ships. (A communication.)

1258. T. P. Salt, Birmingham, surgical instrument maker. Improvements in the manufacture of trusses.

Dated May 20, 1863.

1262. J. Coignard, Nantes, France, watchmaker. Certain improvements in sewing machines.

1264. P. Addington, Phipps-bridge, Merton, Surrey, varnish maker. Improvements in the manufacture of varnishes.

1266. T. Williams, 231, Bolling-street, Bowling, Bradford, York, and I. Naylor, 13, St. James'-square, Horton, Bradford, worsted spinners. Improvements in paper spools or tubes used in spinning and doubling machines.

Dated May 21, 1863.

1270. W. Walker, Manchester, agent and manufacturer. Certain improvements in looms for weaving.

1272. W. Nunn, 179, St. George-street, St. George's-in-the-East, manufacturer of ships' and other lamps and signals. Improvements in the construction of signal lanterns and lamps.

1276. A. Thomalley, Burgh-le-Marsh, Lincoln, brick manufacturer. Improvements in brick kilns.

1278. E. Sonstadt, Loughborough, Leicester. Improvements in the manufacture and purification of the metal magnesium.

1280. J. Goodman, Blackfriars-road, mechanician. Improvements in velocipedes, and in the construction of wheels for the same and other carriages.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated May 22, 1863.*

1282. W. Snell, 16, Clement's-inn, Westminster. Improvements in butt hinges. (A communication.)

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, June 2, 1863.

165. B. Van der Mark. Musical instrument.

178. A. Phillips. Weaving figured fabrics.

189. Sir C. Lindsay. Apparatus to be used on railways to indicate to the engine driver of a carriage-train the length of the time which has intervened since the passing of a previous train.

204. C. Lungley. Facilitating the repairs of ships and other structures.

206. J. Milner. Steam engines.

210. F. N. Gisborne. Communicating signals on board ship.

211. W. Clark. Mariners' compasses. (A communication.

222. A. J. Sax. Rendering drum-skins and gut-strings less liable to hygrometric influences.

224. F. Tolhausen. Weaving ribbons. (A communication.)

230. A. L. Liétout and J. B. Roisin. Gymnastical apparatus.

260. H. Crichley. Reaping and mowing machines. (A communication.)

273. G. Blake. Heating and warming.

292. F. G. Grice. Manufacture of bolts, spikes, rivets, and screw blanks.

295. A. Forbes. Soldering together parts of vessels formed of tin or tinned plate.

296. W. C. Barnes. Shaping, rolling, or compressing metal.

314. G. T. Bousfield. Improvements in postage, revenue, and other stamps, and in apparatus for postmarking and cancelling postage and other stamps. (A communication.)

315. J. J. Hays. Hot air stove.

326. H. Dircks and J. H. Pepper. Exhibition of dramatic and other like performances.

328. R. A. Brooman. Supplying and spreading wool and other filamentous materials on belts, tables, and other surfaces to be afterwards carded and otherwise acted on. (A communication.)

337. R. A. Brooman. Carding engines. (A communication.)

365. **M. Wigzell.** Machinery or apparatus and method to be used in the manufacture of every description of candles, tapers, and other lights.

367. **W. Whitaker and W. Tongue.** Steeping, boiling, washing, bleaching, and dyeing fibrous materials and slivers, slubbings, rovings, yarns, or woven fabrics of the same.

426. T. W. Salmon. Washing machines.

430. J. Gimson. For punching or cutting out leather and other substances.

457. **W. Trustrum.** Manufacture of oiled silk.

487. J. Eckersley. Spinning and doubling silk.

528. **T. V. Lee.** Machinery for digging, compressing, and moulding peat or turf, and for retorts and kilns for drying peat or turf, and making peat or turf charcoal through the agency of hydro-caloric or superheated steam, and for collecting the products of distillation whilst charring the peat or turf.

559. W. Clark. Pumping and forcing water. (A communication.)

598. **D. D. Parsons.** Reaping and mowing machines. (Partly a communication.)

682. C. T. and A. Lutwyche. Metallic pens.

965. J. and T. Richmond and D. Harling. Looms.

974. T. A. Weston. Ratchet levers.

976. G. A. Buchholz. Hulling grain, and for reducing granular substances.

983. W. E. Newton. Improvements in lamps. (A communication.)

1033. J. P. and E. B. Nunn. Hoes and cultivators.

1043. A. V. Newton. Breech-loading firearms. (A communication.)

1058. H. Beare. Thrashing out corn from its straw, and also applicable for combing the straw.

1060. J. and W. Morris. Breaking loaf sugar.

1075. J. Rowley. Recovering the fibres of wool from fabrics or materials composed of wool combined with cotton or other vegetable substances.

1079. E. and F. A. Leigh. Cotton gins.

1090. E. Mitchell. Reaping and mowing machines.

1099. J. Badart. Preparation of rape seed cake, linseed cake, poppyseed cake, niger seed cake, sesseme seed cake, and ground nut cake.

1117. R. G. Kent. Shades and reflectors for gas lights.

1126. W. C. Wilkins. Lamps.

1137. A. V. Newton. Sewing machines. (A communication.)

1159. G. T. Bousfield. Steam engines. (A communication.)

1160. W. Thomson. Obtaining motive power.

1189. T. Warren. Glass and other furnaces or kilns.

1238. E. B. Wilson. Manufacture of iron and other metals.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed May 27, 1863.

3191. J. Cresswell and E. T. Greves.
3192. S. J. Browning.
3194. W. Buller and J. M. Mugford.
3196. J. Adams and W. C. White.
3197. A. Dudgeon.
3200. F. G. Taylor.
3206. J. C. Robertson and C. White.
3211. M. Henry.
3212. H. L. Emery.
3214. G. F. Griffin.
3215. T. Waller.
3217. R. Flude.
3219. J. Romer.
3230. G. F. Blumberg.
3231. J. Wheatley.
3236. A. P. Charles.
3260. T. G. Webb.
3279. R. E. Donovan.
3287. G. A. Huddart.
3306. J. Lamb.
3312. A. P. Price.
3315. W. Clark.
3319. W. Tristram.
3321. R. A. Ronald.
3344. M. Henry.
3349. W. Phelps.
3384. J. Clayton.
3401. J. Dalton.
3432. G. H. Birkbeck.
84. M. Henry.
110. C. E. Amos.
417. W. C. McEntee and G. and T. Withers.
688. W. Smith.
738. J. Saunders and J. Piper.
739. S. L. Crocker.
852. G. A. Cox.

Sealed June 2, 1863.

3262. T. Cook.
3243. C. F. Claus.
3252. J. Braddock.
3256. J. Robinson.
3259. R. Wallis.
3262. L. Christoph, W. Hawksworth, and G. P. Harding.
3263. E. B. Wilson.
3267. W. J. Smith.
3272. J. and M. Craig.
3273. G. Wright.
3274. W. McNaught.
3281. W. Palliser.
3284. J. Sellars.
3288. C. Sanderson.
3290. J. Hilliar.
3291. J. Hilliar.
3292. E. T. Hughes.
3295. T. Wingate, jun.
3296. V. Mirland.
3300. G. Jeffries.
3303. P. Effertz.
3304. W. E. Newton.
3316. J. King.
3320. J. R. Breckon and T. Douglas.
3323. A. W. Burgess.
3324. J. Imray.
3325. W. Goulding.
3329. J. E. Rousses.
3334. S. Fox.
3348. G. Buchanan.
3365. R. Hattersley.
3446. J. H. Johnson.
3469. W. Billinghurst and J. Requa.
196. J. Grant.
880. J. Howard, E. T. Bousfield, and J. Pinney.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1228. H. N. Nissen.
1290. J. Paddon and W. Lowther.
1299. G. Wallis.
1247. J. Craig.
1253. G. Moulton.
1255. J. Green.
1264. J. Paton.
1272. M. Cavanagh.
1286. T. Johnson.
1288. W. Baker.
1289. W. E. Newton.
1291. F. W. Prince.
1295. J. Macintosh.
1306. G. Dowler and G. J. Farmer.
1306. G. Dowler and G. J. Farmer.
1303. G. Elliot.
1307. J. Dale and H. Caro
1308. S. Chatwood.
1313. J. H. Johnson.
1314. W. Tasker.
1316. H. Moule and J. Bannehr.
1328. A. J. Paterson.
1336. W. E. Newton.
1337. W. R. Bowditch.
1343. J. A. Manning.
1347. W. H. Harfield.
1348. C. Clay.
1356. W. Stratford.
1393. J. Saunders and J. Piper.
1426. F. G. Calvert, C. Lowe, and S. Clift.
1573. J. Whitehouse.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1206. A. Allan and T. Hunt.
1252. A. R. le M. de Normandy.
1226. R. Bell.
1250. B. Nadault de Buffon.
1254. W. Hulse.
1255. C. Cowper.
1270. L. D. Owen.
1288. W. Needham and J. Kite.
1297. H. Cartwright.
1291. R. Jobson.
1292. H. Bessemer.
1315. E. Heywood and T. O. Dixon.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending May 30, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
1958	0	8	2859	0	4	2868	0	4	2876	0	8	2884	0	4	2892	0	4
2851	1	0	2860	1	0	2869	0	6	2877	0	8	2885	0	10	2893	0	10
2852	0	10	2861	0	4	2870	0	4	2878	0	4	2886	0	10	2894	0	10
2853	0	6	2862	0	8	2871	0	8	2879	0	6	2887	0	4	2895	0	4
2854	0	8	2863	1	4	2872	1	4	2880	0	4	2888	0	8	2896	0	4
2855	1	10	2864	0	10	2873	1	2	2881	0	4	2889	0	10	2897	0	4
2856	0	4	2865	0	8	2874	0	4	2882	0	4	2890	0	8	2898	1	0
2857	1	4	2866	0	4	2875	0	4	2883	0	8	2891	0	8	2899	0	4
2858	0	8	2867	0	4												

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Dates of Registration.	Nos. in Register.	Names and Addresses.	Subjects of Design.
Feb. 4,	4537	T. Woodward, Brmhm.	Pistol.
„ 10,	4538	H. W. Hart, Fleet-st...	Reflectors.
„ „	4539	J. A. Forrest and Co., Liverpool	Ventilator.
„ 12,	4540	J. Mantle, Birminghm.	Neck chain.
„ 23,	4541	A. W. Cooper, Sheffield	Dessert case.
„ 26,	4542	J. Weeks, Baker-street	Parasol.
Mar. 12,	4543	G. Clarke, Marchmont-street	Fire-escape.
„ 16,	4544	W. H. Phillips, Birmingham	Grindstone spindle.
„ 17,	4545	S. Proctor, Elsecar, Yorkshire	Casing for fire-places.
„ 26,	4546	A. Nash, Royston	Malt screen.
April 8,	4547	J. Mason, Birmingham	Fountain pen.
„ 9,	4548	R. and C. Phelps, Birmingham	Apparatus for producing frost on the stems of jewellery pins.
„ 16,	4549	A. W. Banks, Newgate-street	Bottle.
„ „	4550	W. Bacon & T. Hawley, Coventry	Scarf.
„ 23,	4551	S. Baker, Lombard-st.	Shooting boots.
„ 27,	4552	E. Banes, Newgate-st.	Scarf fastener.
„ „	4553	H. Doulton and Co., Lambeth	Boot warmer.
„ 29,	4554	Benham and Froud, Chandos-street	Jelly mould.

PROVISIONAL REGISTRATIONS.

Feb. 3,	1422	J. Weeks, Baker-street	Parasol.
„ 9,	1423	J. Stone, Hoxton	Bustle.
„ 11,	1424	W. Riddell, Birmghm.	Carving fork.
„ 12,	1425	A. W. Cooper, Sheffield	Dessert case.
„ „	1426	W. Anderson and C. Coe, K	Corner joint.
„ 16,	1427	B. Wartski, Norton Folgate	Coat.
„ „	1428	J. Hall, Queen-st., E.C.	Bread-toaster.
„ 24,	1429	„ „ „	Window fastener
„ „	1430	G. Quilter, Colchester	Printing press.
March 3,	1431	W. Jones, Clapham-rd.	Safety pocket.
„ 9,	1432	L. Glyde, Newmarket...	Chimney-pot.
„ 16,	1433	J. Raywood, Sheffield	Tassel holder.
„ 17,	1434	A. W. Banks, Newgate-street	Bottle.
„ 25,	1435	W. Bacon & H. J. Higginbottom, Coventry	Scoop.
„ 27,	1436	S. Limebear & H. Sharland, Camberwell ...	Cinder screener.
April 18,	1437	J. R. Ede, Barnsbury...	Shirt vest.
„ 20,	1438	E. Herman and J. Conner, Kensington	Trunk.
„ 22,	1439	J. Haseltine, Birmingham	Locket case and pendent.
„ 24,	1440	J. Dobbin, Pimlico ...	Collar.
„ 28,	1441	G. Speight, St. John-street-road	Tab or patch for collars.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	p ct.
IRON:—									
Welsh Bars, in London	per ton	6	10	0	to	0	0	0	2½
Nail Rods	do	7	0	0		7	5	0	
Hoops..........................	do	8	10	0		8	15	0	
Sheets, single	do	9	10	0		9	15	0	
Staffordshire Bars............	do	7	10	0		8	0	0	
Bars, in Wales	do	5	10	0		5	17	6	
Rails	do	5	10	0		6	0	0	nett
Foundry Pigs, at Glasg, No 1	do	2	10	6		2	15	0	
Swedish Bars	do	11	10	0		12	0	0	2½
STEEL:—									
Swedish Keg, hammered ...	do	16	0	0		0	0	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts...	do	96	0	0		0	0	0	3
Hammered Bottoms...........	do	106	0	0		0	0	0	
Flat Bottoms, not Hamrd....	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	8½	
Fine Foreign	per ton	94	0	0		95	0	0	
TIN:—									
English Block..................	per cwt.	6	2	0		0	0	0	2½
do Bar........................	do	6	3	0		0	0	0	
do Refined..................	do	6	8	0		0	0	0	
Banca	do	6	12	0		0	0	0	nett
Straits..........................	do	6	7	0		6	10	0	
TIN PLATES:—									
Best Charcoal, I.C............	per box	1	8	6		1	9	6	
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
LEAD:—									
Pig, English....................	per ton	20	12	6		23	0	0	2½
„ Spanish Soft	do	19	17	6		0	0	0	
Shot, Patent....................	do	23	15	0		0	0	0	
Sheet	do	21	10	0		0	0	0	
White	do	27	0	0		0	0	0	
SPELTER:—									
On the spot	do	18	0	0		0	0	0	nett
ZINC:—									
English Sheet..................	do	23	5	0		0	0	0	2½
QUICKSILVER....................	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	42	0	0		0	0	0	2½

TIMBER, duty 1s. per load, drawback 1s.

Teak.............. load	£12	0	£13	0
Quebec, red pine	3	10	4	10
„ yellow pine .	3	10	4	10
St. John, N.B., yellow	0	0	0	0
Quebec oak, white ...	5	10	6	10
„ birch	3	10	4	10
„ elm	3	10	5	0
Dantzic oak	3	10	6	10
„ fir	2	10	3	10
Memel fir	3	5	3	10
Riga......	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
„ yellow pine	5	0	6	0
Lathwood, Dantzic, fm	5	10	6	10
„ St. Petersburg	8	0	8	10
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	18	10
St. John, white spruce	14	0	15	10
Yellow pine, per reduced C.				
Canada, 1st qual. ...	17	0	18	0
„ 2nd do......	11	0	12	0

Archangel, yellow...	£13	0	£13	10
St. Petersburgh, yel.	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
„ white.	9	0	9	10
Gefle, yellow	10	10	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12ft. by 3 by 9 in.				
Christiania, yellow	21	0	2	
Deck Plank, Dantzic, per 40 ft. 3 in.	0	4		
PUMICE STONE pr ton	5	10		
OILS, &c.				
Seal, pale ...per tun	48	[illegible]	18	10
Sperm body	83	10	85	0
Cod.........................	49	0	50	0
Whale, Sth Sea, pale	45	0	45	10
Olive, Gallipoli	58	0	59	0
Cocoanut, Cochin...	49	0	51	0
Palm, fine	37	0	37	10
Linseed..................	45	10	0	0
Rapeseed, Eng. pale	51	10	0	0
Cottonseed	33	10	42	0

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JUNE 12, 1863.

MARINE ENGINE IMPROVEMENT.

FEW things are more remarkable than the distinctive peculiarities of the different systems of propulsion which have been adopted on land and water—peculiarities which are the primary cause of the marked difference in the results obtained from the combustion of similar quantities of fuel in a locomotive and a steam-boat, and far more the result of that tentativeness with which mankind generally retain the designs, rules, and sundry directions laid down by the successful pioneers of science, than because of any particular advantages which such rules or designs hold out.

We feel little doubt that had James Watt turned his attention with any considerable energy to the construction of a locomotive, he would have succeeded in producing a very excellent machine, and one which, in the absence of anything better, would have fulfilled a very good purpose; but we feel equally certain his engine would have borne about it all the destructive attributes of that system of condensation so peculiarly his own. But James Watt did not invent the locomotive. It is difficult to say who did; but we can at all events trace the result which plays so important a part in our daily affairs to the combined exertions of several individuals, who were all more or less impressed with the conviction that the principle of condensation was totally inapplicable to such a machine, and that from steam of an excessive pressure, as compared with that employed by Watt, could any really useful result alone be expected. This conviction has led to the best results, and we cannot but think it unfortunate that the first promoters of steam navigation did not hold similar views; had they done so, it would ere now have held out advantages which up to the present it has certainly failed to do.

In a former article we endeavoured to point out some of the reasons which have led to the adoption and retention of a peculiarly heavy and cumbrous description of mechanism on board ship, the useful effect of which is extremely disproportioned, if we take a first-class locomotive as our standard, to the space occupied, and the weight and first cost of the machine. But there yet remains a reason, potent in preventing the adoption of anything lighter, which is simply the conviction almost universally held by constructive engineers, that it is impossible to obtain an excessive development of power from what they style small machines. This we admit to be true, within certain limits, which permit a latitude, of which we have been too slow to avail ourselves.

Weight and size are merely relative qualities, and have no immediate influence whatever on the efficiency of any machine whose object is to supply power; least of all, on the steam-engine, whose efficiency depends on many principles with which they have nothing to do. Whether an engine weighs ten tons or or a hundred tons, it may be equally effective and useful, provided the different parts, stationary and moving, are so proportioned as to be capable of sustaining the maximum of force which the machine is capable of evolving; and it therefore follows that the proper consideration for the engineer who has to design engines whose size and weights are limited, is the best means of reducing or rather modifying the strain. They exert, until, without reducing the development of power, they are no longer so excessive as to endanger very light machinery. This has been the guiding principle in the construction of the locomotive almost from the beginning, while it has never once been regarded in its proper light in designing the marine engine, until within the last few years. On the contrary, much has been taken for granted without experiment, because experiment has not been forced on the marine as it has been on the locomotive engineer by the pressure of circumstances. The consequence is that the capabilities of our steamships have been wasted in carrying about tons of useless iron, and, worse still, enormous quantities of coal rendered necessary by the utter disregard of scientific truths, which are now patent to all. Steamships should be something better than mere hulls to carry machinery.

Such engines as the "Lord of the Isles" or the "Great Britain" locomotives, have on many occasions exerted as much as 800 indicated horse power, in regular work. If we neglect the weights of the leading and trailing wheels, springs, &c., as being only necessary to the locomotion of the machine, not to the mere exercise of its power, we shall find that any of them weigh considerably under 40 tons in working order—that is to say, with the boiler full and the drivers retained as flywheels. Now 40 tons divided into 800-horse power, gives us 20-horse power for each ton of dead weight. If we regard 800-horse power as an abnormal effort, which, if long continued, might lead to the injury of the machine, and only consider the maximum of effect as 500-horse power we have still over 12-horse power for each ton. Now, the best practice in marine engineering has hitherto failed to reduce the weight, of direct-acting engines, with tubular boilers and injection condensers, to less than 12 cwt. per horse-power nominal; and as the indicated generally exceeds the nominal, about three times on an average, we may safely say that a ton of the marine machinery in daily use produces but 6-horse power, while a first-class locomotive can produce 12 or 15 with the greatest ease, and even 20 under exceptional circumstances; such facts speak for themselves, and ought naturally to lead to the consideration of the means of procuring equally good results in both cases: the first effect of which would be to place at our disposal a class of vessels possessing all the speed, and two or three times the cargo capacity, of the "Persia," for instance, without any increase in her size. Such vessels could not fail to prove more highly remunerative to their owners than anything which has gone before; and it is sufficiently remarkable that no trials have ever been made with steamships fitted with screw propellers and small engines of the locomotive class, running at locomotive speed with high pressure. We can only attribute this supineness to the small interest which companies generally take in mere engineering concerns—matters which they usually trust wholly to their superintending engineer, who, having all the risk in case of failure, and but little prospect of reward in case of succcess, is commonly well satisfied to do well, without any desire to risk reputation or prospects in the attempt to do better. Nevertheless, the reward held out to shipowners is magnificent, and it is high time they bestirred themselves to obtain it.

We have already observed that on the strength of its parts, the weight of the marine engine is regarded as dependent—a conclusion barely correct in a limited sense; for, after all, the weight of the moving portions of these machines, bears but a small proportion to that of the enormous cylinders rendered necessary by an absurd adherence to the use of low pressure steam, or to the excessive quantity of water carried in their boilers. An excuse might have been heretofore found for carrying about all this dead weight, in the necessity for raising steam from salt water under low pressure, but *tout cela est changé* by surface condensation, and, in consequence, the use of a pressure of 100 lb. or 150 lb. is just as practicable at sea as it has heretofore been on land, and of course in properly constructed boilers is equally safe in either case.

We cannot fail to trace the present state of the problem of marine propulsion to the very circumstances of its history. Taking its rise almost with the advent of steam-power, its introducers were neither aware of, nor regarded as necessary, any means of reducing the size of their engines. The locomotive had not yet been invented; high pressure was in this country almost unknown; the theory of the steam-engine had yet to be elaborated; and consequently they were content with the goods the god's gave them, without searching any farther. Even if they had, so long as paddles remained the sole means of propulsion, their search would have been of little avail, for while confined to their use, it would have been folly to expect any great reduction in the size or weight of the engines which put them in motion; for although the question of speed may not bear any positive relation to the production of power, yet much may depend on the means at our disposal for its subsequent utilization. Until the introduction of the screw there was no opening for high-speeded engines.

Fifty years of progress have dissipated these difficulties and obstacles. The theory of expansion, and the best means of availing ourselves of its benefits, are well understood. High-speeded engines daily prove themselves more successful, and meet with an enlarged application on land. No longer confined to the use of the comparatively clumsy paddle-wheel, we have in the screw an instrument of propulsion above all others adapted to the requirements of a class of engine which cannot fail to give as good results in our steam-boats, as it has in our factories and on our railways. The high speed at which the screw requires to be driven, is still regarded as a great defect; we, on the contrary, regard that fact as the greatest merit of the instrument. Owing to it, the use of enormous pistons moving at slow speeds, becomes a mechanical absurdity; for those principles of construction which have done such good service in the locomotive, are placed at the disposal of the marine engineer. Small cylinders and high speeds may be employed to produce any required power; expansion may be carried to its utmost limit; gearing may in many cases be dispensed with, even with small screws with a fine pitch; and these advantages, combined with surface condensation, and the high pressure placed by it our disposal, should give economical results far superior to anything hitherto attained.

We scarcely think the present style of marine boiler as being the best suited to the circumstances under which it is employed. No part of our steam-boat machinery requires re-modelling more than the means by which we generate steam; but this same question of boiler construction is too large, and opens up far too wide a field, for us to enter on it now. At another time, we may point out some of the more salient points in the construction of that class of engine which holds out the promise of the best results. In the meanwhile, we shall be happy to hear from our correspondents on a subject, which the re-modelling of our fleet renders of paramount importance. When the armour question becomes a little more settled, the question of improvement in our modes of propulsion will, we feel certain, receive much more attention than it does now. It is universally admitted that the power of obtaining high speeds, and maintaining them for long periods of time without having to run for a coaling port, will prove a matter of the most essential importance to the future success of our Navy; and as Government, wisely or not, seldom takes the initiative in such things, we could wish that our mercantile marine would, ere the demand arrives, already supply all the facts and data necessary for the universal adoption of the best means of obtaining these important ends.

GRAIN ELEVATORS.

The processes of thrashing, cleaning, and elevating grain, simple as they may seem, involve operations of such nicety that the whole subject deserves to rank as a separate science. We find on examination, that corn, like air, water, electricity, &c., requires the observance of certain fixed and determinate rules in everything connected with its management, to a degree which the uninitiated in such matters little imagine. The belief obtains that all the varying processes through which it goes, from the time it leaves the farmer's stack, until it is pronounced fit for the miller, can be performed by comparatively rude appliances, which are easily constructed, and exercise no great demand on the inventive abilities of the agricultural engineer. Never was there a greater error; and we do not hesitate to say that the construction of a good thrashing machine involves more difficulties, and requires more accurate knowledge of certain principles, than that of many other machines which are regarded as models of scientific skill properly applied; and we cannot but regard it as strange that the young engineer has not one text-book at his command which can afford him sound theoretical or practical information on this very important subject. The preparation of corn for the market is not so easy a matter now as it formerly was; farmers are no longer satisfied to send their produce to the purchaser in a partially prepared state, which involved a considerable amount of expensive labour on the part of the miller before it could be pronounced fit for the process of grinding; and the growing tendency is not only to bring samples to the highest possible state of perfection, but also to perform all the necessary operations at one time, and in a single machine. When we consider the different descriptions of grain dealt with and the varying states in which it is submitted to the action of this apparatus, we shall be better able to form an opinion of the difficulties involved. It is not our intention at present to enter on the question of the construction of thrashing machinery, but to glance at one of its appurtenances, the Elevator, which bids fair to play an important part in the future of these machines.

From the time that the first mill was built three stories high, it is more than probable that the want of a suitable means of raising corn from the lower to the upper stories made itself felt. The sturdy backs of the miller and his men supplied the want for years in a very effectual manner, we feel little doubt; but growing intelligence after a time pointed out far better means of attaining the same end, and various descriptions of sack-hoist, may still be found in mills of a good old age. The inventors of these ingenious and useful applications of power have all sunk into oblivion, and nothing remains of them but their works. Now, although the hoisting of grain in mass, or by the sack at a time, was found suitable enough to the wants of the miller, it did not by any means supply the demands of the brewer or distiller, who generally keep their corn stored in large receptacles or granaries, from which it requires to be elevated to the upper storeys of the building periodically, in very considerable quantities, quite precluding a resort to the operation of sacking.

The machine designed to fulfil this purpose bears the name of "Jacob's Ladder," and for any evidence we have to the contrary might as well have been invented by the patriarch whose name it bears as any one else. It consists of a broad endless leather belt, running over small wheels—one in the highest storey of the building; the other in the lowest is fixed in a kind of box, which can easily be placed in communication with a hopper into which corn is delivered in a continuous stream from the granaries on the ground floor. On the surface of the belt are fixed a number of tin buckets by means of rivets. Power being applied to the upper pulley, by its revolution it causes the ascent of one side of the belt and the descent of the other, when the little tin cups, dipping into the corn in the receptacle at the bottom, become partially filled with the grain, which they carry to the top and discharge into a suitable spout, on being upset in passing over the upper pulley. The machine is simple, and in such situations, where it has only clean corn to deal with works admirably; once the speed and the feed are regulated, it will, without attention and with unvarying regularity, continue to carry up corn so long as it remains in motion. As a consequence, it has met with almost universal application, and continues to enjoy high favour. Still it is quite incapable of meeting an emergency when more than the normal quantity of grain requires to be raised in a given time. If run above a certain speed the corn is tossed out of the cups, which ascend only partially filled; and although this is a matter of little importance in the regular work of a mill or brewery, in other situations it has become a defect which promises to lead to its supersedal by very different mechanism.

In the first thrashing machines introduced into this country, the inventor satisfied himself with merely extracting the grain from its straw, leaving the subsequent operation of cleaning and dressing to be accomplished by hand in other machines; but the inconvenience of this mode of proceeding soon becoming evident, led to the combination of the dressing, with the thrashing machinery; and as this last always delivers the corn near the ground in the first instance, owing to its working conditions, it became necessary to elevate the thrashed grain to the top of the machine, in order that it might find its way through the dressing apparatus to the sack. The Jacob's Ladder offered the readiest means of attaining this end, and was immediately employed; but it soon proved itself sadly deficient in supplying the demands of the farmer, who could ill brook the frequent stoppage of the machine—a result which constantly took place in consequence of the admixture of considerable quantities of short straw with the corn, which choked up the buckets, got wound on the pulley shafts and filled up the wooden case in which the elevator generally worked. Worst of all, it was frequently found incapable of raising the extra quantities of grain, thrashed from peculiarly productive samples; nevertheless, it remained in general use until three or four years ago, when another Elevator was brought into notice by Messrs. Bruckshaw and Underhill.

One of the most necessary processes which barley, &c., undergoes in its preparation for market, is the removal of the beard or awn. This has hitherto been performed by a machine called a "hummeler" which is simply a horizontal iron tube about 9 in. in diameter and 5 or 6 ft. long, containing a spindle set round with a great number of small blunt knives, which being arranged spirally, force the corn poured in at one end by the elevator, towards the other end, from which it falls on the dressing sieves, the spindle revolving at three or four hundred revolutions per minute. The knives effectually remove the beard or awn, and brighten and improve the general appearance of any corn, bearded or not, which passes through the apparatus. Mr. Underhill accomplishes both the hummeling and elevating of the grain in one operation, by the following means:—

In any convenient situation at the bottom of the thrashing machine, he arranges a fan, very similar to those employed in blowing cupolas and smithy fires. It is usually about 30 in. in diameter fitted with straight vanes, made of stout sheet-iron with the sides turned up about ½ in. These vanes are about 8 in. long and 4 in. wide, and are riveted to stout wrought-iron arms forged with the centre boss in one piece. The fan-case is of cast and wrought iron, only just wide enough to permit the fan to revolve within without touching it; from the circumference of the case above the centre proceeds a tangential inclined wind-trunk, about 8 in. wide by 4 in. deep. The upper end of this trunk opens into a box of peculiar but simple construction, which permits the escape of air, but not of grain. The fan being caused to make about 700 revolutions per minute, sends a powerful current of air up the trunk, while the thrashed corn poured into the bottom of the fan-case by a suitable spout is, by the combined stroke of the fan-blades and the powerful current of air, carried in almost any quantity to the top of the machine, or indeed much higher: the patentees stating that it will elevate 30 ft. with ease.

The action of the fan effectually removes every particle of awn from the corn; indeed, it occasionally does much more, breaking the the grain in a very objectionable manner—a result always due to improper fitting and arrangements, easily avoided by those conversant with the peculiarities of the apparatus. Thus we have known it break corn at 700 revolutions, while it did not injure it in the slightest degree at 1,200 revolutions per minute—a result we attribute to the fact of the corn being elevated rather by the current of air, than the stroke of the fan. In some cases a difficulty is found in finding a suitable place for it on machines not specially intended for its application—a difficulty often got over by taking the wind-trunk from some part of the circumference of the fan-case below, instead of above the centre, which permits the revolution of the fan in an opposite direction. The powerful blast aids materially in carrying off the chaff and dirt, and the machine has hitherto proved itself extremely efficient and satisfactory.

Messrs. Smith and Higgs have introduced an Elevator, whose action depends on nearly the same principles as those which regulate the ascent of water in a pump. Although it has not yet received much attention, being of very recent invention, we believe it may yet be capable of supplying all the requirements which may entitle it to be called a very excellent machine. A fan something similar to that last described, but having peculiarly curved vanes, is mounted on the drum shaft of the thrashing machine. A flat trunk, the opening through which is about 15 in. long and 2 in. wide, proceeds from the centre of the closed fan-case to the lower part of the machine, where it ends in a kind of mouth-piece just over a shallow iron tray, into which the thrashed corn is delivered. The fan runs about 900 revolutions per minute. The word "suck" is neither elegant nor scientifically accurate, yet we can find nothing which better expresses our meaning, for the corn is actually "sucked" up from the tray through the trunk into the fan, from which it is propelled through a second trunk, fixed horizontally, or nearly so, above the dressing machinery, while the air, leaving the corn to make its way through this apparatus, passes down a large tube, and acts the part of first winnower to the rough grain.

The elevating of grain in quantity by this machine depends on many of those nice points of scientific detail, which we have already stated to be largely involved in the construction of thrashing and dressing machinery. The exact curve of the fan-blades, the shape of the elevating trunk, the curve by which it communicates with the interior of the fan-case—all exert a powerful influence on its action. There seems to be little limit to the height to which it will elevate corn; we believe it equal to Underhill's in this respect, and with suitable arrangements it will dress the corn equally well. Curiously enough, three different individuals, each without the knowledge of the others, applied for provisional protection for this invention within a fortnight—a remarkable instance of a similar want giving rise to a similar train of ideas in distinct individuals at the same time.

Messrs. Hornsby, preferring to retain the old-fashioned Jacob's Ladder, yet fully alive to all its defects, have succeeded in so far remodelling it as to construct a very efficient Elevator. Removing the buckets, they have replaced them with flat iron plates, standing at right angles to the surface of the belt, which runs at the upper end on a pulley on the chain shaft, and below on a second pulley, situated within the case, which resembles that usually employed, except that it is lined with roughened iron plates. The corn is delivered into the case at the bottom, and is scraped, so to speak, up the case by the exceedingly rapid motion of the ascending plates on the belt, effectually hummeling it during the process. The belt certainly seems exposed to a considerable amount of wear, but this need not be excessive, provided the pulleys are of fair diameter; and it must be remembered that Underhill's Elevator requires a belt running at a very high speed to drive it; besides, both it and Smith's Elevator require considerable power to drive the fans, in addition to that employed in raising the corn, so that the advantages and disadvantages are pretty well divided amongst them.

The four machines, which we have now slightly described, play an important though indirect part in the preparation of our breadstuffs; and two of them, at least, involve nice questions in dynamics, which make them well worthy of the attention of those interested in such matters. There is still room for considerable improvement, especially in the reduction of the power required to work them. As to their comparative merits, we may say that, although the general principles of construction are the same in all thrashing machines, yet the means of applying them to the object in view are so various that the different forms of this class of machinery are almost endless, and of course the best results can only be obtained by selecting that description of elevator which is most suitable to the form of the machine to which it is to be applied. Not only is there often a practical difficulty in getting the grain to the elevator, but also in getting it away again, and that which might suit one form of machine admirably, might be just as unfitted for another.

HEAT AS A MODE OF MOTION.*

When Sir Isaac Newton enunciated, in his *Principia*, the first axiom or law of motion, by which he proved the indestructibility of force as applied to matter, the illustrious philosopher could scarcely then hope that his axiom would be also brought to bear upon the imponderable agencies of nature. Such, however, is the case; and the doctrine of the conservation of force, through all its transformations, is one of the most pregnant scientific theories of the age.

It could not have long escaped the attention of modern philosophers that the forces of nature are related; that heat could be produced from mechanical action, by means of compression, concussion, or friction. Galvani showed that electricity can be evolved from chemical action; Oersted, that magnetism is developed from electricity. The next step was the perception that—given any two natural forces, either of the two could be evolved from the development of the other. Thus, it was soon found that electricity could break the bonds of chemical union, after being itself evolved from chemical action; and Faraday's discovery of magneto-electricity was the inverse discovery to that of electro-magnetism by Oersted. As Mr. Joule showed in his Paper "On the Heat evolved during the Electrolysis of Water"—"the magneto-electrical machine enables us to convert mechanical power into heat, by means of the electric currents which are induced by it;" and *vice versâ*, that the mechanical power of the electro-magnetic engine is obtained by means of the heat due to the necessary chemical reactions.

It now remained to be proved that these forces were definitely related; that their interdependent reagencies could be expressed by definite numbers; that the science of thermal dynamics could be brought under the dominion of mathematical science, the great goal towards which all real knowledge must tend. Faraday's great discovery of the definite chemical effect of the voltaic current was a step in this direction; and the mechanical equivalents of heat, electricity, magnetism, and chemical action have been at last discovered. We thus not merely know that these forces can do a certain amount of mechanical work, but we also know their separate mechanical equivalents. In the words of Rankine: "As these laws have now been exactly ascertained by experiment, it must be borne in mind that their certainty is in no way dependent on the truth of the hypothesis—the probability of the hypothesis being, on the contrary, dependent on the truth of the laws."

The mechanical theory of heat is based upon the assumption that the atoms and masses of matter, throughout the universe, are steeped in an all-pervading, highly-elastic medium. This boundless sea of "ether" fills all space, connecting atom with atom, and world with world. The universe is supposed to be steeped in this infinitely elastic fluid, just as the spaces of a wetted sponge are filled with water. The force of cohesion keeps the atoms of solid bodies together, but these atoms are supposed to vibrate to and fro across a fixed position, and these oscillations are communicated through the interatomic spaces to the ether in which the ultimate particles swing. The vibrations increase in amplitude, the greater the amount of heat we impart to the body; either directly, or by the application of mechanical action, in the shape of percussion, compression, or friction. Cohesion and heat are thus the two great antagonistic principles from which depend the molecular aggregation of the substances composing the universe. In a solid substance like ice, for instance, cohesion predominates; but the communication of heat will push the particles more widely apart; and the cohesion being weakened by increasing the distance between the particles, the atoms not merely vibrate to and fro across fixed positions, but, at last, can also glide round one another. We thus have the liquid, water. Increase still further the increment of heat—the last fetters of cohesion are broken, and the former solid substance is translated into the gaseous form.

It is indifferent how the vibrations of the body are increased; whether directly by heat itself or by mechanical action. Thus, the old sailor's tradition is correct, that the sea is warmed by a storm; the mechanical dash of the billows is converted into heat. The temperature of the water of the cataract of Niagara also gets somewhat raised by the time the liquid reaches the bottom. Sir Humphry Davy states:—"I procured two parallelopipedons of ice, of the temperature of 29 deg., 6 in. long, 2 in. wide, and two-thirds of an inch thick—they were fastened by wires to two bars of iron. By a peculiar mechanism, their surfaces were placed in contact, and kept in a continued and most violent friction for some minutes. They were almost entirely converted into water, which water was collected, and its temperature ascertained to be 35 deg., after remaining in an atmosphere of a lower temperature for some minutes. The fusion only took place at the plane of contact of the two pieces of ice, and no bodies were in friction but ice." In the course of some striking experiments, Professor Tyndall partially liquified ice by means of pressure. In a famous Paper, read before the Royal Society in 1798 and reprinted in the Professor's works, Count Rumford showed that he had caused water to boil by the application of friction. A bullet, in its passage through the air, is warmed by the friction, and its concussion against the target often causes the projectile to be hissing hot. Mr. Fairbairn informed Professor Tyndall that "in the experiments at Shoeburyness it is a common thing to see a flash of light, even in broad day, when the ball strikes the target." The movement of the ball is thus transformed into molecular motion, and the impulse given by the powder reappears again in the shape of heat, and, perhaps, chemical action. Now, it is impossible to explain any of these phenomena by the caloric theory, which is founded on the supposition of the material nature of heat. Dr. Mueller, in his excellent and well-known work on Natural Philosophy, after citing several instances in which heat is produced by means of friction, declares that there is no explanation of this phenomenon by the use of the caloric theory. As was well remarked by Seguin, in 1839, the ordinary theory leads to the absurd conclusion that a finite quantity of heat produces an indefinite amount of mechanical action; a theory which accepts the possibility of a perpetual motion, which is, of itself a *reductio ad absurdum*. All modern science acknowledges the principle that we cannot, by any combination of forces or matter, produce either force or matter out of nothing. Several other anomalies and contradictions were involved in the use of the old caloric and emission theories. As is well known, different bodies have different capacities for heat. Thus, to raise a pound of water 1 deg. would require thirty times the amount of heat necessary to raise a pound of mercury 1 deg.; *vice versâ*, a pound of water in falling 1 deg. would give up thirty times more heat than mercury; and the "specific" heats of these two fluids would be represented by the numbers 1·00 and 0·0333 respectively. The caloric theory explained this difference by supposing that some substances contained more heat than others. The mechanical theory of heat gives a more rational reason for this difference. Heat being mechanical action, the reason that some bodies require more heat to raise their temperatures is, that a greater amount of *interior work* must be performed in order to drive their ultimate particles asunder. In cooling, the heat consumed in forcing the atoms wider apart is restored by their contraction. "The energy of the forces engaged in this atomic action and *interior work*, as measured by any ordinary mechanical standard, is enormous." "Gravity almost vanishes in comparison with these molecular forces." Thus, water expands on both sides of 4 deg. Centigrade or 39 deg. Fahrenheit; at 4 deg. C. it has its maximum density. "Suppose a pound of water heated from 3½ deg. C. to 4½ deg. C.—that is, 1 deg.—its volume at both temperatures is the same; there has been no forcing asunder whatever of the atomic centres, and still, though the volume is unchanged, an amount of heat has been imparted to the water, sufficient, if mechanically applied, to raise a weight of 1,390 lb. a foot high."

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* Heat as a Mode of Motion; being a Course of Twelve Lectures delivered at the Royal Institution. By John Tyndall, F.R.S. London: Longman and Co. 1863.

The caloric or materialistic theory is particularly illogical when it attempts to explain the phenomena which accompany changes in the state of aggregation of bodies. The heat that disappears in changing the state of a body from the solid to the fluid and gaseous stages, was supposed to hide itself in some unknown manner in the intermediate spaces of the fluid or vapour. It was termed "latent" heat. According to the *mechanical* theory, the heat expended in changing the state of aggregation of bodies is "virtually the lifting of a weight," and is consumed in conferring potential energy upon the ultimate atoms. In order to make this action clearly understood, we might draw an analogy between this action of heat, and effect produced by gunpowder in driving a shot from a rifled gun. A portion of the powder is expended in giving a forward motion to the shot; another portion is consumed to produce the rotary motion of the projectile.

An amount of heat sufficient to raise the temperature of water by 1 deg. of Fahrenheit's thermometer, requires for its production 772 foot-pounds of mechanical power. The expenditure of the same amount of power will also raise 1 lb. of water to 1 deg. Fahr. This "dynamical specific heat of water" is known by the name of "Joule's equivalent," having been first determined by that gentleman through a series of experimental researches extending over many years. (772 foot-pounds being the mechanical equivalent for 1 deg. Fahr.; 1,390 foot-pounds is the equivalent for 1 deg. Centigrade.)

In a most interesting and striking manner, Professor Tyndall traces the existence of water through its various stages. 1 lb. of hydrogen, in combining with 8 lb. of oxygen, to form water, will raise 34,000 lb. of water 1 deg. C. "Knowing the number of foot-pounds corresponding to the heating of 1 lb. of water 1 deg. C., we can readily calculate the number of foot-pounds equivalent to the heating of 34,000 lb. of water 1 deg. C. Multiplying the latter number by 1,390, we find that the concussion of our 1 lb. of hydrogen with 8 lb. of oxygen is equal, in mechanical value, to the raising of 47,000,000 lb. 1 ft. high!" When this combination is effected, the substance is in the state of vapour; it first sinks to 212 deg. Fahr., and is afterwards condensed into water. The atoms of oxygen and hydrogen clash together and form the compound substance, steam; and molecules of the steam then fall together and form the liquid, water. The mechanical value of these acts can be also calculated. Thus, "9 lb. of steam in falling to water, generate an amount of heat sufficient to raise $967 \times 9 = 8{,}703$ lb. of water 1 deg. Fahr.; multiplying this number by 772, we have a product of 6,718,716 foot-pounds as the mechanical value of the mere act of condensation. The next great fall of our 9 lb. of water is from the state of liquid to that of ice, and the mechanical value of this act is equal to 993,564 foot-pounds. Thus, our 9 lb. of water, in its origin and progress, falls down three great precipices: the first fall is equivalent to the descent of a ton weight urged by gravity down a precipice 22,320 ft. high; the second fall is equal to that of a ton down a precipice 2,900 ft. high; and the third is equal to the descent of a ton down a precipice 433 ft. high."

We are now naturally led to inquire the names of the men who achieved the most in effecting this great and revolutionary progress in modern science. The history of most great discoveries, or even of the humbler inventions in trade, show how difficult it is to adjudge the palm of merit. There are several claimants to the major part of the glory. Professor Tyndall ascribes the principal honour to Dr. Mayer, of Heilbronn; M. Seguin claims it for his uncle Montgolfier, as is evidenced in a letter we published in our number for January 30th (page 78). Mr. Grove and Mr. Joule both claim the exclusive honour of the discovery. It appears to us that this discovery, like many others, has been evolved from the labours of several men working during many years; and it has been evidently long ago dimly sighted by several who have been raised by genius above their fellows. The practical connection of heat with motion must have been perceived from time immemorial; savages procure fire by the friction of two pieces of wood, and civilized men by the concussions of flint and steel. "In the common flint and steel the particles of the metal struck off are so much heated by the collision that they take fire and burn in the air."

It may be said that three great steps have led to a full explanation of this phenomenon, and justice will be best done by apportioning the honour due to the advance of each separate gradation. The original step was made by those who first conceived the idea of heat as a mode of motion. A dim glimpse of the connection of heat and mechanical force was already formed by Aristotle. Remarkable passages from Bacon are cited by Professor Tyndall, showing that Bacon rejected the idea of caloric as a material substance. Almost every advance we make in science thus adds strength to the well-known and beautiful comparison by the poet Cowley between Lord Bacon and the Prophet of Israel standing on Mount Pisgah.

As we approach our own times, the previously dim glimpses of truth get more vivid. We thus find Locke writing two centuries ago:—"Heat is a very brisk agitation of the insensible parts of the object, which produces in us that sensation from whence we denominate the object hot; so that what in our sensation is *heat*, in the object is nothing but motion."

The second great step was taken by Rumford and Davy, who distinctly proved by experiment that heat was developed by friction. Professor Tyndall reprints, as an Appendix to his second lecture, "A Paper by Count Rumford, read before the Royal Society in 1798, entitled 'An Enquiry concerning the Source of the Heat which is excited by Friction.'" Count Rumford says:—"It appears to me to be extremely difficult, if not quite impossible, to form any distinct idea of anything capable of being excited and communicated in those experiments, except it be *motion*." We refer our readers to our number of January 30th for an exposition of M. Seguin's claims. Mr. Grove appears to have systematized the previously loose and isolated conceptions as to the law of mutual convertibility. In the preface to his last edition of his "Correlation of the Physical Forces," he claims to have expounded this law in January, 1842.

The *mechanical equivalent* of heat was determined by Mayer, of Heilbronn, and Joule, of Manchester, and the last and most important step was thus taken towards the formation of the science of thermo-dynamics. Mayer determined, by calculation, the mechanical equivalent of heat from the velocity of sound in air, and he published his paper in 1842. By experimental means, and completely independent of Mayer's researches, Mr. Joule also determined the mechanical equivalent of heat. Mr. Joule showed the elevation of temperature caused by the revolution of paddles in a suitable vessel filled with water, as also with mercury and sperm oil; he measured the heat evolved from the friction of cast-iron discs against each other, and also the heat produced by forcing water through capillary tubes. By these experiments he was enabled to determine the mechanical equivalent of heat. We are thus almost wholly indebted to Mr. Joule for the experimental researches which have led to the present position of the question. Since Joule's determination of the mechanical equivalent of heat, the subject has been mathematically investigated by Clausius, Helmholtz, Holtzmann, Kirchhoff, Rankine, and Thomson. It remains to be seen who will first practically apply the new philosophy; that many applications are possible, we have no doubt. As Joule remarks: the new principles "lead to a theory of the steam-engine very different to the one generally received, but at the same time much more accordant with facts. From them we may infer that the steam, while expanding in the cylinder, loses heat in quantity exactly proportional to the mechanical force which it communicates by means of the piston, and that on the condensation of the steam, the heat thus converted is *not* given back. Supposing no loss of heat by radiation, &c., the theory here advanced demands that the heat given out in the condenser shall be less than that communicated to the boiler from the furnace, in exact proportion to the equivalent of mechanical power developed." The enormous consumption of power by means of friction can be explained upon no other hypothesis than that of "Mechanical effect = Heat." The mere rubbing effect of two rough surfaces against each other, the mere catching of the prominences of one surface by those of the other, are not causes sufficiently powerful to account for the almost instantaneous consumption of power by friction. When the breaks are applied to a railway train, a winding engine, &c., the power of the steam is mainly reconverted into heat.

New and revolutionary theories like the one we are alluding to have a disturbing influence on many men's minds. They effect changes in our old ways of looking at the things passing daily before our eyes, and they cause revolutions in our ordinary views too fundamental and startling to be quite pleasant. That original thinker and observer, Archbishop Whately, has well noticed that the common love of mankind for novelty affects only details; new systems in science have attractions for only a select few, while they disturb the minds of the many.

Professor Tyndall uses alternately and indifferently the scale of Fahrenheit, and that of Celsius or the Centigrade thermometric scale. In some cases this is liable to lead to a little perplexity on the part of the reader. It is unfortunate that the absurd scale of Fahrenheit cannot be entirely banished from our scientific works. Founded on the wrong assumption that the zero corresponded with the total absence of heat, its use is an anomaly in the present state of science; while the inapplicability of its numbers to the decimal notation, often causes a serious loss of time.

A want has long been felt amongst engineers for a clear and intelligible work on the mechanical theory of heat, and which would, at the same time, give an account of the scope of the experiments, and numerical data upon which the theory is founded. This want is now supplied by Professor Tyndall's book. The clear style of the work adapts it to the most ordinary capacities; and the reader is raised to "the level of these questions from a basis so elementary, that a person possessing any imaginative faculty and power of concentration" can easily follow the subject. The engravings are also well chosen, and excellent in execution, while they completely carry out their true purpose—that of fully illustrating the context. With the exception of a short portion of Lecture IX. in Mr. Fairbairn's work, "Useful Information for Engineers," this book of Professor Tyndall is the only popular exposition of thermal dynamics. Popular as it is, however, we are nevertheless convinced that the most accomplished man of science would rise from the perusal of this book with an additional amount of information.

VAILE'S PROPELLER.*

That man would be rash who asserted that we had arrived at the best means of propelling vessels. Neither paddle nor screw can be considered as doing more than approaching towards that theoretical perfection which our greatest engineers have searched after since the days of Symington or Fulton. We feel disposed, then, to look favourably on every attempt made to improve our existing systems, convinced as we are that the whole subject of steam navigation is as yet in its infancy.

Mr. Vaile's propeller comes late on the field, as compared with paddles or screws—a fact which must militate seriously against its general adoption, apart from every other consideration. This is to be regretted, as the principle on which it is constructed seems theoretically right, which is more than the warmest advocates of other systems can assert. And those matters of practical detail, which will doubtless be found difficulties—but not, we imagine, insurmountable ones—will in consequence be regarded as being of far more importance, than if the three modes of propulsion, paddle, screw, and Mr. Vaile's, had all started in the race for public favour at the same time.

The greatest objection hitherto urged against propellers of this kind has been the wear of the chains. This we regard as a mere matter of constructive detail. If the chains are made correctly on scientific principles, with case-hardened eyes, steel pins, and a sufficiently large bearing surface where the links take the cogs, so to speak, of the chain wheels, the wear will be found very trifling. We have used chains on somewhat similar wheels in traction engines ere now, where they have for miles at a time been exposed to a strain of 15 or 20 tons, the chain running at about two miles per hour, without either jerk or perceptible wear. On one occasion, with a new chain, with link pins at every 8 in., and much more roughly made than Mr. Vaile's arrangement of jointed rods would be, we found the chain stretch half an inch in a journey of 120 miles, and this was solely due to the chain coming to a bearing in the first 20 miles.

For various reasons which we cannot enter on very fully, we fear Mr. Vaile's propeller will never prove very suitable for oceanic navigation. The fact of two shafts being necessary, and the complication of the whole machine, must, we think prevent its coming into favour, under circumstances which have excluded the feathering paddle-wheel. Ice, on the North American routes, frequently demolishes half the float boards, and even twists the wheel arms, of our trans-Atlantic steamers, and has indeed proved so mischievous, that the feathering wheel has fallen into complete disfavour for these boats.

But Mr. Vaile has, in our opinion, a field open to him quite large enough to afford fame and fortune. We consider his propeller eminently adapted to the exigencies of river navigation. The shallow water in which it will work, the powerful hold which it can take of the water when ascending currents, the small height of its centre of gravity, are all advantages which must tell on engineering opinion. The rivers of our Indian possessions offer a fair opening, and we think Mr. Vaile would do well to turn his attention to the introduction of his invention in that quarter.

The little pamphlet before us is written well, and as impartially as anything of the kind can be, and is certainly an able exposition of a system which bears strong evidence of intrinsic merit.

LIGHTHOUSES AND ELECTRICITY.

The bump of caution is largely developed in the heads of the members of the Trinity House, developed, indeed, to a degree which we only find equalled in the craniums of the honourable members of the Board of Trade. It is now some time since these gentlemen were afforded a fair opportunity of displaying the effects of this bump; and we feel little doubt that the comparatively recent attempts which have been made to introduce the electric light, as a substitute for oil lamps in our lighthouses, have been hailed by them as an opportunity of displaying that devotion to economy for which they have been so justly celebrated. Indeed, were a feasible plan laid before these gentlemen whereby the sun could be compelled to remain above the horizon the twenty-four hours through, as he does for six months of the year in high latitudes, we have every reason to conclude that they would still adhere to the use of oil lamps and parabolic reflectors, as far superior means of showing a ship her whereabouts.

Lord Lovaine addressed the House of Commons on this important subject on Friday last. Mr. M. Gibson's reply is a model for all legislators who are asked questions they feel no desire to reply to. It might have meant anything; it did mean nothing; caution is necessary, is a virtue when properly exercised, but becomes one of the worst of faults, in a public body, when overdone. The electric light has for nine months proved itself at Dungeness superior to any other light ever introduced as an aid to navigation. Mr. M. Gibson regards this as "a very promising experiment," nothing more.

England is generally considered to possess the most valuable navies, warlike and mercantile, in the world; we also possess, unfortunately, as dangerous shores as can anywhere else be found, within the compass of the few hundred miles which are able to girdle our island. Our wrecks, alas! can be counted each year by the hundred. The misery involved thereby no man can count; yet in the darkest night, on the most treacherous shore, the hardy mariner deems himself safe, if he can but see and recognise the well-known light which is to him a beacon of safety. The finger of science points out the most powerful light yet known, as being ready to our purpose—a light distinguishable from all others, ruling paramount over storm and mist, resembling nothing but the bright sun in noon day in its character. Experience has tested and proved its value month after month; but caution and parsimony interfere; and for the sake of a little gold, we refuse to avail ourselves of the greatest benefit which science has yet held out to the sailor. The receipts from lighthouse dues already exceed the expenses of their maintenance to an amount which might, perhaps, supply sufficient funds, not only to fit up every structure of the kind on our coast with the electric apparatus, but also to permit the adoption of arrangements which would allow of the immediate substitution of the ordinary lamp in case of the accidental failure of the new system.

During the nine months that this light, and the machinery necessary for its production, were tested at Dungeness, it became extinguished but once for 2 minutes, once for 30 seconds, and on 18 other occasions for shorter periods of time, during the hours at which it should have been alight; and this, be it remembered, under the supervision of attendants so careless, that on several occasions they nearly permitted the steam boilers to explode. Mr. Holmes' system cannot be called untried or unsuccessful after such an experiment.

As to the quality of the light, it is unnecessary to speak; the greatest opponents to its use, on other grounds, admit that, as a light, it is superior to anything which has gone before. Of its ultimate universal introduction we feel little doubt; but under the present "cautious" system, we much fear that many stormy winters will elapse before that desirable end is attained. A heavy responsibility rests on those who have the means of introducing another element of safety in all that concerns our home navigation, and yet hesitate to do so, from that supineness and parsimony, improperly called caution.

STREET RAILWAY BRIDGES.

The distinguishing characteristic of modern engineering works is unmitigated ugliness. The fact is patent to every one. The goddess of taste has flown. Venus and Vulcan separated from incompatibility of disposition hundreds of years ago, and do not seem likely to become better friends in this matter-of-fact age of ours.

The extension of railway communication through the metropolis opens a new field for street architecture. Bridges of all forms are likely to span our leading thoroughfares, and might, for anything we can see to the contrary, be made "things of beauty," if not "joys for ever." But the specimens we are already favoured with are anything but encouraging. Witness the new tunnel at Southwark-road. Perhaps, hereafter, these things will be profusely decorated. Paint is cheap; a ton of cast-iron moulding and trellis-work is very inexpensive and easily applied, with, we apprehend, the result of making that which is already bad very much worse. A magnificent gilded frame would scarcely place a public-house sign-board on a par with a Titian or a Murillo. We want beauty of form, not meretricious decoration.

It is urged, with some show of reason, that it is difficult to construct a very short bridge which shall be handsome. The same objection has, seemingly, applied with considerable force to

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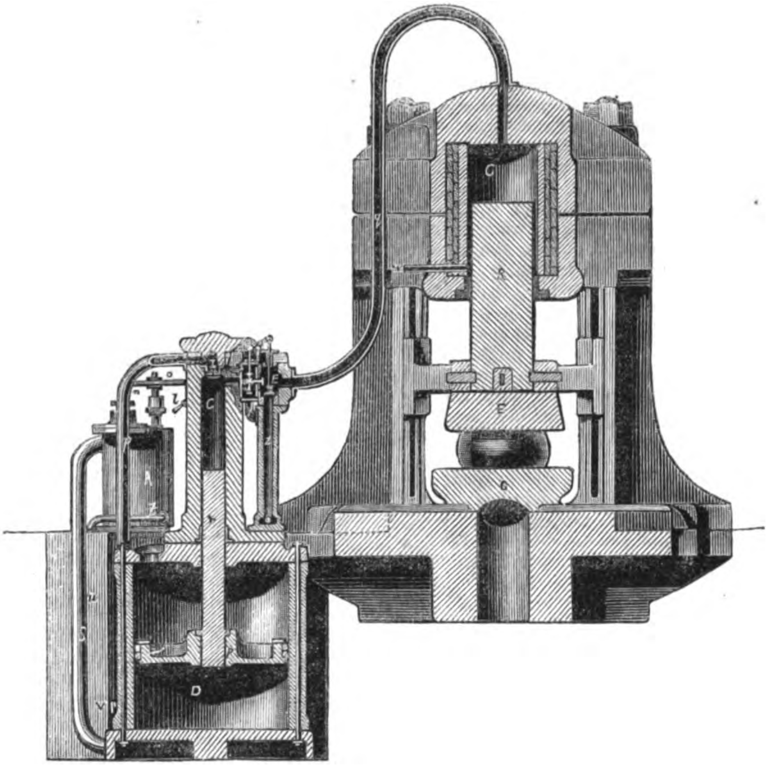
* Vaile's Patent Endless Chain Propeller, for the more Rapid and Economical Propulsion of Ships. By Robert Vaile. London: Saville and Edwards. 1863.

SHANKS AND KOHN'S HYDROSTATIC PRESS.



some of our long ones; but the colossal size of some of these works, conveys an idea of sublimity to the mind which makes us forget their ugliness. Unfortunately, this does not apply to bridges of 60 ft. or 70 ft. span; and, without much careful designing, such structures are likely to be very useful, perhaps, but very hideous as well.

A correspondent of one of the daily papers suggests that an open-work foot-bridge might be carried across the street at each side of the main girders which support the railway. The idea is a good one, and would, if well developed, give a lightness of appearance to such bridges which would add materially to their beauty, and these foot-ways would, besides, supply a want generally felt in crowded parts of the town—such as Ludgate-hill. The extra cost would be very trifling, not much more, perhaps, than that of scrolls and false panels, which, though they may decorate, cannot beautify.

SHANKS AND KOHN'S HYDROSTATIC PRESS.

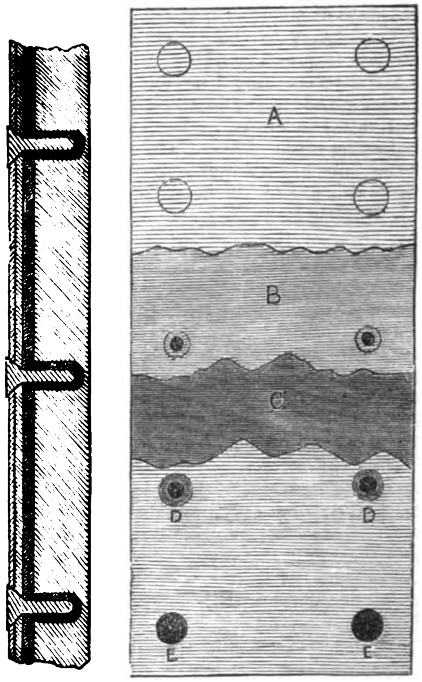
The improved hydrostatic press illustrated in section in the accompanying engraving, has been recently patented by Messrs. Shanks and Kohn, of Robert-street, Adelphi.

The improvement consists in working a hydrostatic press by steam power in such a manner as to exert the direct pressure of the steam upon the water in the main cylinder of the press by opening a free communication between the cylinder and the boiler, and move the ram by the direct pressure until the resistance of the object operated upon be equal to the pressure, at which moment steam is admitted under a large piston operating on a ram of smaller diameter in communication with the main ram, so that the motion of the lesser ram produces on the lesser one an increased pressure in the ratio of their respective areas.

The press cylinder C is mounted on standards. The ram R carries the face or upper mould F, and the anvil or lower mould G is made to slide on the sole plate so as to be drawn from under the upper mould to a convenient distance for receiving the article from the frame, and afterwards to be returned to its central position to be operated upon. A is a vessel connected by a pipe with the steam space, and by a second pipe with the water space of the boiler; a slide valve worked by a wheel *o*, or any other suitable arrangement, being provided for opening and shutting off the communication. A pipe *p* leads from the bottom of the said vessel A to the space *c*, which communicates with the main cylinder of the press C by the pipe *q*. The ram of the press cylinder R has at its upper end a piston packed on both sides; and a third packing is applied against the ram at the bottom of the press cylinder. An annular space is formed under the piston of the ram R, which is brought into direct communication with the water in the boiler by the pipes *t*, *v*, and *w*, leading through the vessel *u* and the valve *x*. The upper part of the vessel A contains a weighted valve *n*, which, when lifted by the steam pressure, admits the steam through the pipe *s* under the piston of the large steam cylinder D, which is connected to the small hydraulic ram *r*. The valves E and *x* can by means of levers be made to open a communication between the press cylinder above and below the piston and the water reservoir, open to the atmosphere, through the pipes *y* and *z*; but during the action of pressing these valves are closed.

For bringing the press into action, the valve *o* is opened, and the communication between the boiler and the vessel A established. The water from the bottom of the vessel will be forced through the pipes *p* and *q* into the main cylinder of the press, and exert a pressure on the ram R proportionate to the pressure in the boiler. The communication between the boiler and annular space under the piston of the ram R being also established, the ram will be forced down with a pressure corresponding to the difference of the sectional areas of the whole piston and the said annular space; this direct action will continue so long as the resistance to the descent of the ram is less than the pressure on the weighted valve *n*, but as soon as this pressure is arrived at, the steam will lift the valve, and get access to the piston in the large cylinder D. The total steam pressure on the piston P will thereby be transmitted to the ram *r*, and this will exert upon the main ram R a further downward pressure in proportion to the respective areas of the two rams. By closing the valve *o*, the exhaust passage of the steam cylinder D is opened, and the pressure upon the ram R is relieved; the boiler pressure maintained under the piston of the said ram forces it upwards so long as the water from the main cylinder can follow the ram *r* in its descent. By these means the two moulds of the press are made to approach each other to a definite distance, each stroke regulated by the quantity of water between the two rams R and *r*. For raising and lowering the ram R without exerting pressure, valves E and *x* are provided. The opening of E causes the escape of water from the cylinder and the ascent of the ram by the upward pressure against the piston. The valve *x* when placed in the position shown allows the ram to descend by its own weight, and to draw water from the reservoir into the press cylinder.

MUNTZ'S PATENT SHEATHING FOR IRON SHIPS.



In our last number we mentioned that a specimen of this sheathing had been exhibited at the *conversazione* of the Society of Civil Engineers: we now append a drawing of the invention.

When Muntz's patent metal is applied to iron ships, it is necessary that it should be perfectly insulated, which is done under this patent by placing sheets of india rubber or ebonite between the metal and the ship.

The nails for attaching the sheathing to the iron ship must also be insulated; and small holes, about ½ in. diameter and ¾ in. deep, are drilled in the iron of the ship, to correspond with holes in the sheathing; and in these holes plugs of ebonite are driven, which receive the nails and completely insulate them from the iron of the ship. (*See drawing.*)

The shortness of the nail may be objected to; but experience has shown that a nail ¾ of an inch in length, driven into the ebonite plug, supported as it is by iron, requires a greater strain to draw it than a 1½ in. nail driven into oak.

The drawing will, we think, illustrate the subject sufficiently without further description.

CHEMISTRY OF STEEL.

A continuation of M. Caron's[*] researches on this subject relates to the function performed by manganese in the production of steel. Regarding it as a fact that all good steel is obtained from spathic or hematite ores highly impregnated with manganese, and assuming that the presence of this metal is almost essential to the production of steel, he has endeavoured to ascertain the nature of its influence. He states that, by means of a suitable addition of metallic manganese, pig iron may be deprived of the sulphur and silicium it contains, but that no influence is exercised in the eparation of phosphorus.

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[*] *Comptes-Rendus*, lvi., 828.

The pig iron with which he experimented is described as of very good quality, containing only traces of silicium, and it was melted by means of wood charcoal as free as possible from phosphorus, sulphur, and silicium.

One portion of this pig iron was melted with a known quantity of iron phosphide; another portion, with iron sulphide; and a third, with iron silicide. The three kinds of iron thus obtained were the subject of the experiments.

Two equal quantities of the phosphuretted iron were melted in crucibles; in the one instance without any addition, in the other instance with 6 per cent. of metallic manganese. The manganese used gave on analysis:—

Iron	1.0	100
Carbon	5.5	
Silicium	0·5	
Manganese	93.0	

The metal was kept in fushion for one hour, and then poured out. During the operation the metal was slightly decarbonized by the oxidising action of atmospheric air. Analysis of these two portions of iron gave the following percentage results:—

	Phosphorus.	Manganese.
Phosphuretted iron	0·83	
No. 1 Phosphuretted iron melted alone	0·82	
No. 2 Phosphuretted iron melted with 6 per cent. manganese	0·80	4·58
No. 1 Melted again without addition	0·79	
No. 2 Melted again without addition	0·78	3·74
No. 1 Melted a third time without addition	0·78	
No. 2 Melted a third time without addition	0·76	1·62
Phosphuretted iron melted with 10 per cent. iron oxide	0·76	
Phosphuretted iron melted with 10 per cent. iron oxide and 6 per cent. manganese	0·74	1·37

These results appear to indicate that, in refining phosphuretted pig iron, manganese does not effect the separation of phosphorus.

	Sulphur.	Manganese.
Sulphuretted iron	1·15	
No. 1 Sulphuretted iron melted alone	1·14	
No. 2 Sulphuretted iron melted with 6 per cent. manganese	1·15	3·92
No. 1 Melted again without addition	1·09	
No. 2 Melted again without addition	0·10	2·81
No. 1 Melted a third time ,, ,,	0·96	
No. 2 Melted a third time ,, ,,	0·08	1·73
Sulphuretted iron melted with 10 per cent. iron oxide	1·08	
Sulphuretted iron melted with 10 per cent. iron oxide and 6 per cent. manganese	0·07	1·22

These results show that, by simple fusion with access of air, manganese effects the separation of 7-10ths of the sulphur in the pig iron. Repeated melting, without further addition of manganese, does not produce any considerable effect, and it appears that the proportion of manganese should be large, for by remelting the same metal with a fresh quantity of manganese the sulphur may be almost entirely separated.

	Silicium.	Manganese.
Siliciетted iron	0·99	
No. 1 Silicietted iron melted alone	0·88	
No. 2 Silicietted iron melted with 6 per cent. manganese	1·30	4·77
No. 1 Melted again without addition	0·80	
No. 2 Melted again without addition	1·66	2·98
A. Silicietted iron melted with 10 per cent. iron oxide	0·61	
B. Silicietted iron melted with 10 per cent. iron oxide and 6 per cent. manganese	0·37	2·52
A. Melted again with 10 per cent. iron oxide	0·52	
B. Melted again with 10 per cent. iron oxide	0·18	1·10

The manganese used in these experiments contained silicium, and in this way, as well as by reducing the silica of the crucible, added to the amount of silicium in the iron. But this is not the case when the iron is decarbonized by the addition of iron oxide.

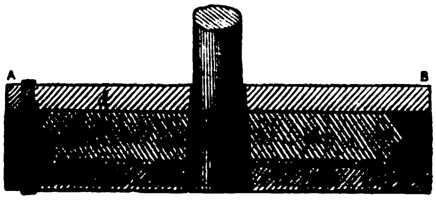
It may be inferred from these results therefore that manganese determines the separation of a large portion of the silicium in pig iron.

These results agree with practical experience. The ores above mentioned, that yield the better kinds of steel often contain sulphur, but never contain phosphorous; and it is a noteworthy fact that, although those ores contain copper pyrites, the pig iron they yield does not contain sulphur.

Although manganese does not determine the conversion of iron into steel, as Karsten has well shown, it is nevertheless certain that—besides rendering steel capable of being welded—it has an influence in improving the quality of steel. M. Caron considers that this influence may be explained by the aid of facts which he has formerly made known. When a sufficient quantity of manganese is added to grey pig iron, the carbon of which is to a great extent in a free state, white pig iron is obtained, in which the carbon is almost entirely in a state of combination. The effect is the same with steel; a very small addition of manganese is sufficient to retain the carbon in a state of combination, and, in consequence, to confer on the metal the characters peculiar to good steel. However, the amount of manganese in steel must not exceed 5-1000ths; more than that renders steel hard and brittle, the surface of fracture becomes crystalline, and the metal is deficient in tenacity.

It is a common practice in refining iron to mix ordinary pig iron with manganiferous pig iron, and the above results show that the beneficial effect of this practice is greater according to the amount of manganese present. It appears therefore to be a point of practical interest to reduce manganiferous ores in such a manner as to obtain the largest possible amount of manganese in the pig iron. The spathic ore of the Siegen district contains from 15 to 20 parts manganese for 100 of iron; but the pig iron made there does not contain more than 6 or 7 per cent. of manganese. M. Caron considers that if this amount could be increased to 10 per cent. the commercial value of the pig iron would be increased.

RIPLEY'S IMPROVED PISTONS.



Mr. A. Ripley, of Lambeth, has just patented an improvement in pistons, which consists in causing the rings composing the packing of the piston to expand so as to exactly fit the cylinder by means of the pressure of the steam, air, or liquid. To effect this a double cone is formed on the periphery of the block or portion into which the piston rod is fitted, the exterior packing ring is placed over this, leaving a small space between the two; within this space is another ring, the interior having the same angle, and accurately fitting one of the cones before mentioned, the outside pressing against the exterior packing ring; a corresponding ring is fitted to the other cone, which also presses against the outside packing ring. Through each cover of the piston are several studs or projections, which touch the edges of the inside rings, so that when the steam is admitted on either side of the piston it will press the studs down, thus acting upon and enlarging the inner rings by forcing them further over the cone, and consequently the exterior packing ring. By calculating the surface of the studs or projections any degree of pressure can be obtained.

The accompanying engraving shows a sectional elevation of a piston constructed as above described.

a is the solid plug or body of the piston, upon the periphery of which the double cone is formed for expanding the ring wedges; *b*, *b*, the cone rings or inner expanding ring wedges; *c*, the outer metal packing ring; *d*, *d*, the covering plates or junk rings in which the miniature pistons *e*, *e*, are fitted; *f*, opening left between the coned ring to allow for this being pressed inwards and expanding over the solid cone when impelled by the force at the steam or fluid acting upon the miniature pistons, thus causing the outer packing ring also to expand and take the exact form of a transverse section of the cylinder at all parts of the stroke, thereby maintaining the steam or liquid-tight condition, notwithstanding any irregularities in the cylinder arising from imperfect boring, previous unequal wearing, or other causes. When necessary, the miniature piston-heads may be fitted with flexible diaphragms for increasing their power, and increasing their steam or vapour-tight action.

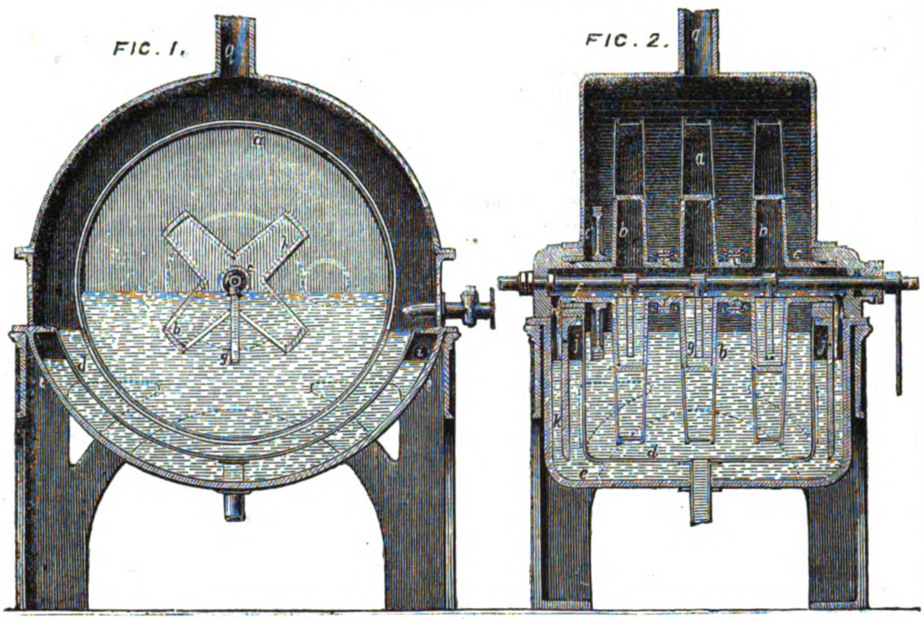
GOLD QUARTZ.

A new method of depriving gold ores of sulphur has been introduced at the mines of Pike's Peak: It consists, says the *Scientific American*, in reducing the ores to fine dust, then forcing the dust by a draft through a flame of pine wood. The furnace used is a square brick structure, with a grate about 3 ft. wide by 4 ft. in length, and 3 ft. high, in which a fire of common pine wood is built. The flame from this fire-place escapes into a chimney built in the shape of a muffle, and, instead of rising upward, runs down toward the lower floors at an angle of forty-five degrees. The tube containing the ground quartz enters this muffle-shaped chimney at its upper end, just where the blaze from the furnace enters, and the strong current carries the flame its whole length. There are several round holes, an inch or two in diameter, at intervals of 3 ft. or 4 ft. along both sides of the chimney. Through these, when the apparatus is in operation, a further supply of air than that furnished by the blower is sucked in and assists in decomposing the sulphur contained in the ore. In passing down the flue or chimney the pulverized ore is blown through a jet of flame, as dust, for a distance of about 20 ft. —the length of the flue—and each particle being separate, is surrounded by air and a strong flame, and it becomes red hot, giving off its sulphur, arsenic, and other volatile constituents. After passing down the flue, it falls into a receptacle of brickwork, whence it is raked out upon an earthen floor to cool. The ore now presents about the same appearance as that burned in a reverberatory furnace—a brick red. The amalgamation machinery is simply an arrastra about 8 ft. in diameter, with a stone bottom and dragstones. This is a very novel process; and three times more gold, it is stated, are obtained by it than by any of the old processes.

Sulphur, arsenic, and iron in quartz prevent, in a great measure, the mercury from amalgamating with the gold.

The *Phare de la Manche* says:—"It appears certain that the Emperor will visit Cherbourg about June 20, for the purpose of inspecting the iron-clad fleet which will then be collected there. The frigates "Couronne," "Normandie," and "Solferino" are at present in dock undergoing repairs, and their officers and crews are to be changed or modified. We learn that the "Gloire" and "Invincible" are under orders to leave Toulon for Cherbourg. The number of iron-clad vessels will be six, as the "Magenta" is to come from Brest, and they will form a squadron, of which it is said that Vice-Admiral Rigault de Genouilly will have the command. It is expected that these six vessels will perform evolutions in the presence of His Majesty."

PEEK'S EVAPORATING APPARATUS.

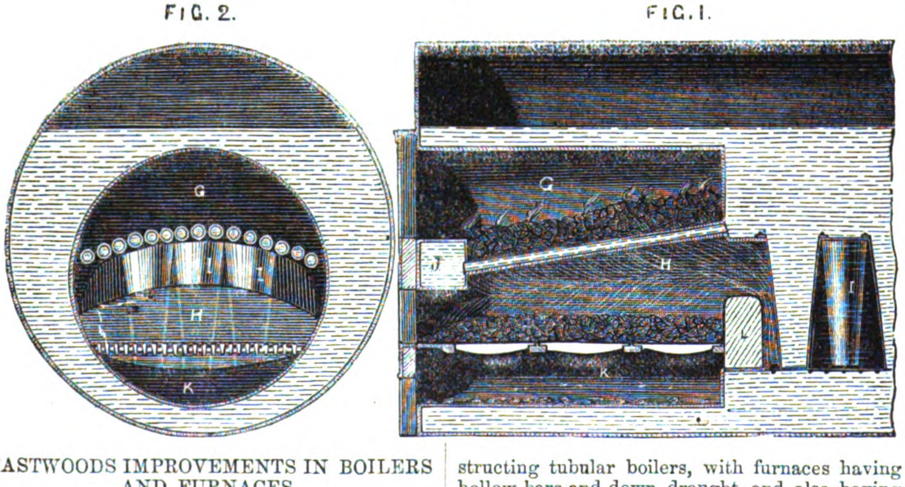


PEEK'S EVAPORATING APPARATUS.

THE above engravings show in sectional views an apparatus for evaporating saccharine and saline solutions, recently patented by Mr. A. Peek, of Manchester. The invention consists in applying the heat necessary for evaporating the solution in such a manner that the temperature of the solution cannot be raised beyond the boiling point of water, but it may be kept to any required degree below that temperature.

a, a, a, are three hollow discs or agitators, made by preference of sheet copper, attached by rivets or otherwise to the arms *b* of the hollow axle *c*. The agitator revolves slowly in the pan *d*, which is placed within the outer pan *e*. The steam pipe *f* passes through the hollow axle *c*, and it is supplied at one end with a stuffing-box, and at the other end with nuts, and a shoulder to prevent the leakage of steam or water through the outer casing of the apparatus. To the pipe *f* are connected the three branch pipes *g*, which are open at their ends to convey the steam from the pipe *f* to the hollow discs *a*. This steam, as it condenses into water, overflows into the passages *h* at each end of the hollow axle *c*, which convey the water into the space between the pan *d* and outer pan *e*; the overflow is carried off through the orifice *i* and through a syphon pipe or trap; the small orifices *j, j*, in the partitions *k, k*, are to allow the water to overflow freely into the space between the pans *d* and *e*. The saccharine or saline solution to be evaporated having been run into the pan *d* through the supply pipe, a slow rotary motion is given to the agitators by means of a shaft, driven by a steam-engine. The exhaust steam from the engine is conveyed to the pipes *f* and *g*, placed, as before described, within the agitators; this exhaust steam supplies the heat required for the evaporation. The orifices of the branch pipes *g* can thus be brought nearer to or above the surface of the water in the agitator for the purpose of heating more rapidly at the commencement of an operation. The vapour rising from the saccharine or saline solution in the pans *d* is carried off by the pipes *g*, which are in communication with a fan. When the requisite degree of evaporation has been obtained, the saccharine or saline solution is run off out of the pans *d* by the pipe beneath. Two or more of these apparatuses may be worked in combination with each other, and may be placed on different levels to facilitate the running of the solution from one pan to the other.

EASTWOOD'S BOILERS AND FURNACES.



EASTWOODS IMPROVEMENTS IN BOILERS AND FURNACES.

A PATENT has been obtained by Mr. H. Eastwood, of Elland, Yorkshire, for improvements in boilers and furnaces. The improvements consist in combining and arranging, or constructing tubular boilers, with furnaces having hollow bars and down draught, and also having a furnace of ordinary fire-bars underneath, whereby a great amount of heating surface is obtained, a rapid circulation of the water therein produced, the fuel economised, and the smoke consumed. The boiler shown is of the cylindrical form, with one fire-box, but having two furnaces or fire-places G and H. The fire-box is joined to an oval fire-flue, in which are a series of vertical tubes or water passages I opening at each end with the interior of the boiler. The grate bars of the furnace G are made of wrought-iron tubing open at one end to the boiler above the flue, and at the other to a water space J, which opens at each end to the boiler, and also forms the dead plate. The grate bars of the furnace H are of the ordinary kind, with an ashes place K underneath; and there is a bridge of brick or fire-clay L to the back as usual. Both furnaces are provided with doors, and those to the upper are perforated to admit air. The upper furnace is supplied with coal, and the flame and smoke, or gases, pass down through the grate bars to the flue. The under furnace is fed with coke and the incandescent fuel or cinder falling from the upper furnace, the flame and intense heat from which, arising and passing towards the flue comes in contact with, and ignites the unconsumed gases and carbonaceous matter passing from the upper furnace. The intense heat of the fires acting on the hollow grate bars generates steam rapidly, which is constantly passing into the steam chamber of the boiler, and water is supplied thereto from the water-space, so that a continous current or circulation is mantained through these tubes; also the great heat in the flue acting on the vertical tubes produces, in like manner, a continual passing of the water from the bottom of the boiler to the upper part, and thereby obtaining a more uniform temperature of the water, consequently more equal expansion and contraction of the parts, and therefore less wear and tear in boilers. It will also be observed that this boiler possesses a great amount of heating surface, whereby steam is generated very rapidly and with great economy of fuel.

UNSWORTH'S IMPROVEMENTS IN STEAM ENGINES.

THIS invention relates to certain combinations of the valves, cylinders, and ports of steam-engines, with a view to avoiding compression or back pressure in the main cylinder. For this purpose, according to one arrangement, the pipes or passages employed to convey the steam to two small cylinders alternately are placed close to each end of the main cylinder, and additional ports, which are to prevent back pressure or compression, are placed within about 2½ in. of each end of this cylinder, so that when the piston reaches the end of the cylinder it covers the port which has been opened to prevent back pressure; but so soon as steam is admitted into the large cylinder it moves the piston valve in the small cylinders, and closes the port upon which the main piston is standing, opening at the same time a port at the opposite end of the main cylinder; this is performed whilst the crank is travelling over the centre. The steam admitted into the small cylinder returns as soon as the exhaust port is opened to the large cylinder; this arrangement prevents any escape of steam. If preferred, the steam may be admitted into the small cylinder or cylinders direct from the boiler.

In another arrangement, a single small cylinder is used in combination with valve boxes attached to each end of the main cylinder, suitable pipes or passages conveying the steam from the large cylinder to each end alternately of the small one. The two valve boxes in connection with the small cylinder are opened in turn as soon as the steam is admitted into the opposite end of the small cylinder, to allow of the escape of the steam under compression in the main cylinder.

Fig. 1 of the annexed engravings represents a longitudinal section of the upper portion of a locomotive or other steam-engine cylinder with these improvements attached; fig. 2 is a corresponding plan of the same; and fig. 3 is a transverse section taken through one of the small cylinders, bed plate, and portion of the main cylinder.

a is the main steam cylinder, and *b* its piston,

UNSWORTH'S STEAM ENGINES.

FIG. 1.

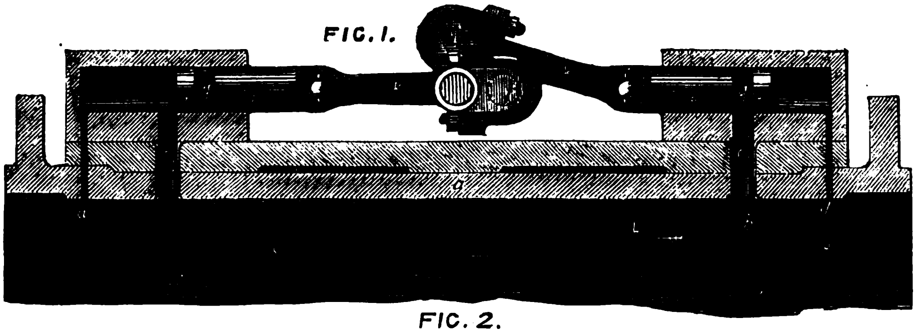


FIG. 2.

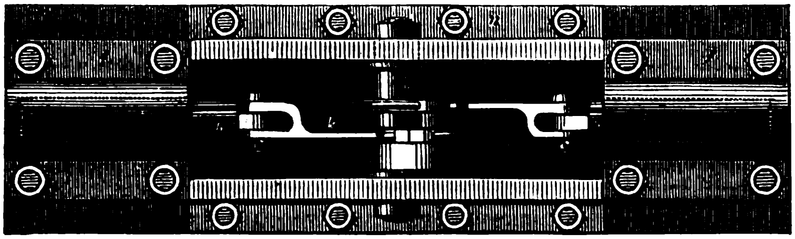
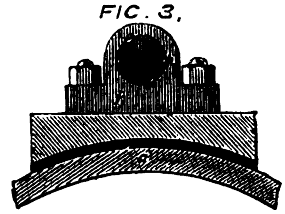


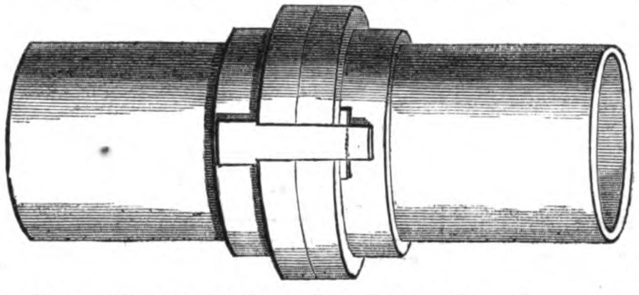
FIG. 3.



which latter is represented as covering one of the two additional ports *c*, *c*, which are made near each end of the main cylinder for the free escape of the back pressure steam, hereinafter designated as the "compression." A small steam port *d*, *d*, is also made in each end of the main cylinder, leading, like the larger ports *c*, *c*, into the small supplementary cylinders or valve boxes *f*, *f*, within which work steam-tight the piston valves or plugs *e*, *e*. A wide groove or annular recess *g*, *g*, is formed in each piston valve, and into these annular recesses or grooves run a number of longitudinal grooves or slots *h*, *h*, (shown clearly in fig. 3), these longitudinal grooves or channels serving as outlets for the free escape of the "compression;" the two piston valves or plugs *e*, *e*, are connected together, so as to work in concert with each other, by means of the connecting rods *k*, *k*, which are jointed by means of the pins to the outer ends of the plugs; the contiguous ends of the two connecting rods are respectively coupled with the cranks *l*, *l*, set at right angles on a short shaft, which works in brackets bolted down upon the bed plate. To this same bed plate are also bolted the small cylinders *f*, *f*, so that the whole of the apparatus is contained on the bed plate, and may, therefore, be readily fixed to the cylinder of a locomotive or other steam-engine. The piston *b* is supposed to have just completed one stroke, and the port E of the cylinder (in connection with the exhaust) is full of steam, which is confined therein, and exerts a back pressure upon the piston on its return stroke after the exhaust port of the slide valve has been closed. So soon, however, as the steam enters the cylinder *a* on the steam side S of the piston by the usual port and side valve, a portion of the steam passes by the small port *d* into the small cylinder *f*, and by the time the main piston *b* is in motion, the plug or valve *e* in this cylinder has been forced by the steam pressure beyond the port *c*, so as to close all outlet for the acting steam, which would otherwise escape through the part *c* so soon as it was uncovered by the main piston *b*. This forward movement of the plug *e* is transmitted through the cranks and connecting rods to the opposite plug in the other cylinder. The effect of this movement of the plug is to bring the recessed portion over the port, whereupon the "compression" or back pressure steam escapes freely along the grooves or channels in the plug during the full stroke of the piston, and after the ordinary exhaust port has been closed; hence, the resistance or back pressure hitherto exerted against the piston whilst it is completing its stroke is entirely obviated. These valves or plugs are operated in like manner at each stroke of the main piston *b*, the in-coming steam at one end of the main cylinder opening the valve or plug for the escape of the "compression" at the opposite end.

TAYLOR'S JOINTS OR CONNECTIONS FOR PIPES AND TUBES.

The accompanying engraving illustrates an invention patented by Mr. W. Taylor, of Newport Pagnell. The invention consists in forming a flange or collar on the ends of pipes and tubes, in making undercut grooves in the collars, and on the employment of dove-tailed cottars, formed with a head at one end and a slot at the other, for the reception of a key, which cottars slide into the grooves, and are tightened-up by the keys being driven into these slots.



THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.—VAILE'S CHAIN PROPELLER.

At the monthly meeting of the above Society, held on Saturday, the 6th inst.—Mr. Joseph Newton in the chair—the discussion on the principle and details of Mr. Vaile's new system of marine propulsion was renewed. Mr. Walker, who re-opened the question, commenced by saying that, when on the occasion of their May meeting Mr. Newton had so fully explained the action of the new propeller, he (Mr. Walker) was under the impression that Mr. Vaile had simply resuscitated an old scheme of the well-known Symington. It was only fair now to acknowledge that this was not the case. He had compared the two plans of propulsion, and found that they widely differed, the points of difference being all in favour of the more recent one. The floats were attached to the chains in a simpler manner than in Symington's, whilst the feathering properties of the floats and the total submergence of Mr. Vaile's apparatus were entirely novel features. Still, however, he was of opinion, in spite of these palpable advantages, that difficulties of a practical nature would be found to militate against the success of the scheme before them. The number of working parts in the chain-wheels would lead to their derangement, and this was one source of inferiority. The screw was simple, and, if less effective in theory, would be found more durable, and less liable to accident, in practice. He must admit that some strong claims to superiority, as regarded the avoidance of the evils of slip, for example, might be, and indeed had been, advanced on behalf of the Vaile propellers, and in their general principle he himself agreed. It might be possible that his own objections were more imaginary than real, and that an experiment might have the effect of cancelling them. It was difficult for those whose whole experience had been confined to screw or paddle-wheel to divest themselves entirely of prejudice, or to grasp suddenly the ideas of an inventor who left the beaten track and suggested something very different to the prevailing systems of marine engineers.

Mr. Oubridge, apart from some minor objections, which referred solely to mechanical details, believed that Mr. Vaile's efforts were in the right direction, and thought that that gentleman might legitimately hope for a considerable amount of success. The main principle of the submerged feathering-floated propeller was, he believed, correct and in accordance with natural laws. As for less important points in connection with it, a few experiments might set them at rest. This was precisely one of those plans in relation to which the practical test alone must be the final arbiter. The screw and the paddle-wheel had gone through many stages of mutation, and they both had their disadvantages even now. Mr. Oubridge trusted that ere long the propeller of Mr. Vaile would be put into practical competition, and that on a sufficiently large scale with its powerful competitors.

Mr. Ives saw an insurmountable obstacle, as he thought, to the extensive introduction of Mr. Vaile's propellers. In order to obtain anything like speed in a ship fitted with them, the chains would have to travel at the rate of 1,000 ft. per minute, and if this speed were to be obtained by the media of toothed gearing, the wear and tear of the one and the shock to the other would soon prove fatal to both. As to the feathering properties of the floats, he believed that some of the largest steam navigation companies were abandoning feathering floated paddle-wheels, and this was an argument against feathering floats generally.

Mr. Ross considered that the last speaker had jumped at conclusions, rather than advanced towards them by sound reasoning. He saw no objection to the rate of speed at which the chains and floats would have to travel, provided the links and joints were properly fitted; and as to the "shock" to the gearing spoken of, he could not see how it was to arise when the floats were constantly submerged, and the resistance to be overcome was always the same. He believed, moreover, that it was only in exceptional cases that Mr. Vaile proposed to use gearing at all. As a general rule, he understood direct-action engines on the horizontal principle were intended to be employed, and these would be in every way preferable to gearing. As to the abandonment of feathering paddle-wheels, he was in a position to assert that the most recently fitted-up steamship of the West India Mail Company was supplied with them. Looking at the whole plan of Mr. Vaile dispassionately, he (Mr. Ross) was disposed to think most favourably of it.

Mr. Meredith Jones had seen much of the links used in the chains of dredging barges, and his experience led him to disapprove of the introduction of chains for the purposes of marine propulsion. They would, he thought, be found noisy in action and liable to accident. The joints would get "play," and the pins would have a tendency to work loose. The principle of applying the propelling power as low down as possible in the vessel was in itself good, but it was difficult to see how it was to be economically effected.

Mr. Stabler, though approving of the ideas of marine propulsion advanced in Mr. Newton's Paper of the previous month, saw, he confessed, some impediments to their practical establishment. Murray's chain pumps were constructed on a plan not dissimilar to that of the chain propellers, and they could not be worked very rapidly without inconvenience. For Canal, and River navigation, however, he believed the Vaile propeller would be found admirably adapted. He had nothing to say against the principle of the invention. Theoretically, indeed, he must admit that the advocates of the endless chain propeller were right; perhaps it might prove that they were so practically. Time and actual experimentation alone must determine that point.

Mr. Stanley imagined that there would be some trouble in keeping the pitch of the chains equal. There would be a tendency to elongation, which would manifest itself at the outset, and probably increase in a quick ratio.

Mr. Vaile having been called upon by the Chairman to do so, undertook to reply to the various objectors. He explained the mode in which repairs to the apparatus might be effected, supposing them to become necessary, and whether it was applied in a totally or partially submerged position. If the chains were fitted at the joints, as he intended they should be, with steel pins working in hard wood bushes, he thought that the wear and tear would be imperceptible, even after many months' working. The speed at which the chains would be made to travel would vary from 600 to 1,000 ft. per minute, and he saw nothing impracticable about that. As to any shock arising from the action of the float-arms against the guides, such an idea was visionary. The arms, indeed, might be said never to leave the guides at all, as a reference to the diagrams would show. It was his favourite idea to employ direct-action engines with small cylinders and rapid stroke; but if gearing were to be employed in connection with engines of large cylinders and long slow stroke, he imagined that all purposes would be served equally well. Mr. Vaile replied *seriatim* to the other exceptions taken to his plans, and concluded his remarks amid considerable applause.

The Chairman said that before closing the interesting and instructive proceedings of the evening, he should be glad to offer a few remarks. These went to demonstrate his entire approval of the submerged feathering endless-chain propeller, and his belief that some day, and that not a far distant one, it would effect marvellous changes and improvements in Steam Navigation. He had given great attention to the principles and details of the apparatus; and the more he had reflected upon it, the more was he convinced of its practicability and value.

Mr. Newton having announced that two Papers would be read at the July meeting—one by Mr. Muir, of Woolwich, on "Forgings;" and the other by Mr. Stanley, on "A Substitute for the Slide Link Motion"—the discussion closed. Before the meeting separated, a resolution was passed to open a subscription for the assistance of Mr. Robert Armstrong, C.E., whose painful case Mr. Newton introduced to his brother members in a feeling manner.

APPLICATION OF THE PRINCIPLE OF THE DIVING BELL.

A correspondent of the *Colliery Guardian* says that an interesting and successful experiment was last week made at the Dearnley Colliery, near Rochdale, under the following circumstances:—About a month ago, owing to the breaking of the bucket-dagger, the cylinder cover and the engine beams were broken, and during the time required to repair the engine, the water had risen to a considerable height in the shaft. When repaired, the engine worked well till Sunday, the 17th, when it was observed that there was not quite so much water delivered by the pump. This deficiency was more observable on Monday, and on Tuesday it was seen that the pump delivered no water at the down-stroke. It was supposed the bottom valve or "clack" did not close, and other suppositions were made, but they were mere guesses, seeing that some twenty yards of water were in the pit shaft. The engineer remarked that if a diving-bell could be sent down it could be discovered what was the cause of the pump not lifting. The proprietors of the colliery immediately acted on the idea, and believing that a diver might be found who would go down, and possibly not only discover but remedy the defect in the pump, went immediately to Liverpool and called on Mr. Rodrigues, an employer of divers. After a little explanation, Ellis Javons, the diver who was so successful in the "Royal Charter" wreck, agreed to go over to Dearnley and attempt the repair. He went over with another diver, Thomas Allen, but after inspecting the pit, they telegraphed for John Bulmer to assist them. A platform was constructed about sixty yards down the shaft for the air-pump to be worked upon, near to the water. On Thursday morning Javons, being equipped in diver's dress and helmet, was lowered into the water, the pumping engine working very slowly. He had previously very carefully studied the plan of the pump, and had fully explained to him the *possible* causes of the defect. Besides the pipe which conveyed air to the diver, he had a line tied round his body for safety and for signals. After he had been in the water about twenty minutes, a signal was given for the engine to work quick. The diver ascended in half-an-hour, and brought up with him four or five broken screw bolts which had fastened the flange of the pump-tree above the bucket-door, and he said that when the engine worked quickly the water at the down-stroke came out at the joint with such violence that he was hurled to the side of the pit, and at the up-stroke his whole body was drawn with great force against the opening; and it was observed at the top of the pit that the pump worked well at that time, and it was believed for a moment that he had succeeded in mending the pump. In the afternoon, he again went down, taking with him new bolts and a powerful key. He was this time under water an hour and three-quarters, and when he came up, said that he had put all the bolts in, and was screwing the last bolt when he broke it, and cracked the flange, and this necessitated his again going down on the following morning, which he did, and finished repairing the joint and made a careful examination of the rope, the bucket-door, and the joints of the pump-trees, and all he declared to be in good working order. The engine was set to work, and the pump has worked very well. The diver, the proprietors, and the workmen, were all well-pleased at the success of the attempt, believing, too, that in similar doubtful cases the services of the diver may be most advantageously resorted to, and that at a very considerable saving of money and time.

Meetings for the Week.

Mon.—*British Architects.*—At 8 p.m.

Wed.—*Geological Soc.*—I. "Relations of the Sandstones of Cromarty with Reptilian Footprints," by Rev. G. Gordon and Rev. J. M. Joass. Communicated by Sir R. I. Murchison. II. "Tertiary Shells from Jamaica," by J. C. Moore, Esq. Note on the Corals, by P. M. Duncan, Esq. III. "New Fossil Thecidium from the Miocene Beds of Malta," by J. D. Macdonald, Esq. IV. "Sandstones and Shales of the Oolites of Scarborough," by J. Leckenby, Esq. V. "A Monograph of the Ammonites of the Cambridge Greensand," by H. Seeley, Esq. VI. "Geology and Mineralogy of a part of Borneo," by M. C. de Groot. Communicated by Sir R. I. Murchison, at 8 p.m.

Thurs.—*Antiquaries.*—At 8.30 p.m.
Linnæan Soc.—At 8 p.m.
Royal Soc.—At 8.30 p.m.
Chemical Soc.—At 8 p.m.

Fri.—*Architectural. Assoc.*—Class of Design—Cemetery Monument.

TO CORRESPONDENTS.

The Mechanics' Magazine is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the Mechanics' Magazine at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the Editor, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

A Sufferer.—Your observations are pertinent and sensible; and such a committee as you speak of might prove useful provided it consisted of honest men. The suggestion contained in the last part of your letter proposes nothing more than an act of justice.

T. W.—We regret that it is quite out of our province to aid you.

H. K. (Edinburgh).—We think that, having for the present closed this discussion, it would be unfair to other correspondents to reopen it just yet. Perhaps, at a future day, when fresh facts have accumulated, we may do so, when we shall be happy to hear from our able correspondent.

Received.—J. N.—W. A.—J. W.—F. A. P.—H. K.—J. H.—W. W.—T. T. H.—D. M.—W. B.—R. S.

Correspondence.

[We do not hold ourselves responsible for the opinions of our correspondents.]

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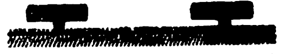
FOULING OF IRON SHIPS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

Sir,—The fouling of the immersed portions of iron ships, both of the Royal Navy and of the mercantile marine of this country, is a subject of such vital national importance, that no really inexpensive means holding out the slightest prospect of success should be left untried.

I beg to send you four proposed mechanical means of preventing the fouling of the immersed portions of iron ships which I have submitted to the Admiralty, but which their lordships decline to bring to the test of experiment. I have now added a fifth mode, and hope that as these proposed plans are generally very simple and inexpensive, that some of the mercantile marine may give some of them a fair trial.

1. Let small dovetail grooves be placed upon the side of the ship from the water-line, or some distance above it, and reaching down to the keel, 2 ft. or 3 ft. apart, and not projecting from the skin of the ship more than 3-16ths of an inch, thus—



Into the upper end of this groove would be inserted a thin plate of steel, which would be pushed down in the groove as far as the keel, and adhering so closely to the skin of the ship as to detach every substance, whether vegetable or animal, which would be attaching itself in an incipient state to the sides or bottom of the ship. This steel plate would then be drawn up and placed into another groove, until the whole of the immersed portion had been passed over by the steel plate or scraper. This process could be carried on while the ship is under weigh, and could be repeated as often as necessary to prevent any accumulation of animal or vegetable matter on the immersed portion of the ship.

It will, no doubt, be objected, that these projecting fillets necessary to keep the scraper close to the side of the ship will themselves form an impediment to the sailing of the ship. This is readily granted to the extent of the thickness of these fillets, and, therefore, experiment alone can prove the utility of this mode of the prevention of an existing evil.

But supposing the whole of the immersed portion of the ship to be covered with moveable steel plates, which would be occasionally drawn out and polished, might not this arrangement so diminish the skin resistance of the ship through the water as to add two or three knots an hour to her speed?

2. Construct a crib or cage large enough to hold a man, air and water-tight, with framework to prevent it from collapsing by the pressure of the water, and to keep the waterproof covering 5 or 6 in. from the side of the ship. In the side of the cage opposite to the side of the ship (and probably also in some other portions of it), a bull's-eye would be placed for light, and sleeves would be attached for the arms of the operator, the palms of the hands being covered with brush. Thus equipped, the cage with the operator securely seated inside, and supplied with air from the deck, would be lowered down, and would commence scrubbing the ship's side opposite to him in vertical strips, as far as he can reach on each side. A rope would also be passed under the keel and taken up at the other side of the ship (and probably fore and aft guide ropes), in order to keep the cage close to the bottom of the ship when passed below the bilge.

By passing this scrubbing process two or three times a week over the immersed portion of the ship, it is presumed that no accumulation can take place. Whether this process can take place when the ship is under weigh or not, experiment alone can prove; but a man-of-war going to sea for a three years' cruise will, doubtless, be able to find some quiet lull to give the vessel's sides a scrubbing as well as the decks. The construction of this crib could be so modified that only the upper part of the covering would be constructed as a frame in order to get rid of the weight and inconvenience of the helmet. An apparatus of this kind would be extremely useful on board of all ships in order to examine any external damage the ship might sustain under water.

3. Pass ropes under the keel of the ship to the deck on each side; to these ropes attach swabs, or rather flat mats, which may, if necessary, be armed with a brush covering. These mats would be so

attached to the ropes as to be kept flat to the side of the ship, and so arranged, that when the mat on one side of the ship would be descending, the other would be ascending. These mats would be drawn up and down several times over the same space, and then passed to a fresh portion of the ship's side. Should brushes be necessary, they should not be so hard as to rub off the paint from the side of the ship.

4. Pass a rope under the keel of the ship and tighten the ends of it to each bulwark, that the rope may be kept close to the side of the ship; to this rope or gasket let a number of points or tails be attached, nearly touching each other, 2 or 3 ft. long, and extending along the whole of the immersed portion of the rope. The vessel being under weigh, these points or tails would float from the rope towards the stern of the ship, and keep up a slight friction against the sides as to prevent or destroy any animal or vegetable substance from adhering to the surface over which these points were kept playing.

The rope would be placed in a fresh position every hour or half-hour, as might be found necessary, in order that every immersed portion of the ship could be passed over as often as would be found necessary to keep the ship perfectly clean.

5. A flexible tube or cone, sufficiently buoyant to float horizontally in the water, about 10 or 12 ft. long, and covered with bristles or flexible whalebone, probably about 6 or 8 in. in diameter; one end of this circular brush would be supplied with a swivel, which would enable it to turn round freely, and to the other end would be attached a light brass or copper screw, adapted to revolve rapidly by the current of water passing along the side of the ship. The apparatus being thus prepared, the swivel end is attached to a rope, which is passed under the keel and taken up at the other side of the vessel. When the apparatus is drawn down to the water and the ship under weigh, it would be carried horizontally towards the stern and put in rapid rotary motion by the current acting upon the screw of the tail end, and thus frictional action would be carried on to any extent over the immersed portion of the ship, by gradually lowering the apparatus as far as the keel, and then passing the rope to a fresh portion of the ship's side. This process could be repeated as frequently as would be found necessary for the purpose of preventing any lodgment of animal or vegetable matter.

Soon after the introduction of steam, it was discovered that concretionary substances became attached to the inside of the boilers, and as it thickened deteriorated the heating qualities of the boiler, and the boiler was also much injured by detaching the concretionary coating. Chemistry did its best to find a solvent, and but very partially succeeded; a mechanical means was then tried, that of frequently "blowing off," and when properly attended to is found simple and efficient. The fouling of ships' bottoms is precisely an analagous case. The evil is great—the accumulation of extraneous matters on the immersed portion of the ship deteriorates her sailing qualities, and injures the skin in the operation of cleaning. Chemistry has been at work for a considerable time, and as yet to very little purpose. Why not give mechanical means a fair trial?

I am, &c.,

Alex. Doull, C.E.

Miscellanea.

We have received a sample of oil from Messrs. Field and Co. We can pronounce it an excellent article, and well adapted to the lubrication of machinery, not manifesting any tendency to glaze or crisp, even after long exposure in a thin film to the atmosphere.

At the Seamless Copper Tube Works at Morrissania, Yew York, pure copper is cast into sound tubular ingots by running the metal into moulds, revolving 2000 times in a minute.

Many of the American iron furnaces are blown with a pressure as high as10 lb. on the square inch; the largest running off 280 tons, of 2,000 lb. each, of pigs weekly.

It is claimed by American agriculturists that Minnesota is a great State for the culture of flax, and as linen can be substituted for cotton almost wholly, the dominion of King Cotton might be disturbed by its cultivation.

We hear that the high and middle level sewers of the main drainage of the metropolis will be partly in operation in two or three months' time, when, perhaps, Father Thames will be relieved of half the title he at present possesses to be considered the largest and filthiest drain in the world.

The "Tyne," the launch of which from the yard of J. Wigham Richardson and Co. took place on Saturday, after being towed up to Newcastle, got her machinery put on board, steamed back to the builders' yard, and was moored there, in the short space of fourteen hours from her launch—an instance of despatch which reflects the greatest credit on the engineering staff of Messrs. R. and W. Hawthorn, by whom the machinery was supplied.

A prospectus has been issued by the General Petroleum Company, with a capital of £200,000, in shares of £10, to carry on the business of an oil refinery and paraffin candle factory upon an extended scale.

The following puff appeared in the City article of the *Times* on Tuesday:—"Mr. Nathan Thompson, whose new process of boatbuilding by machinery is now in operation at East Greenwich, has just invented a method, which promises to become of great commercial importance, for securely stoppering all descriptions of bottles. The stopper is stated to be simple in construction, easy of application, perfectly efficient, and so economical that it will probably come into general use, as by its adoption the necessity of wiring and capsuling would be entirely dispensed with." We calculate the Americans show pretty considerable smartness in availing themselves of the Britishers' press for their own purposes.

A letter has been received from Mr. W. M'Gregor, Chairman of the Institution of Mechanical Engineers, respectfully requesting the patronage of the Mayor of Liverpool to the proposed session of that society in Liverpool in August next, and for his influence in obtaining the gratuitous use of the small Concert-room in St. George's-hall, for the purposes of the society, on the 4th, 5th, 6th, and 7th of the above month. On the motion of Mr. Livingston, seconded by Alderman Bennett, it was resolved that leave be granted for the use of the room.

At a recent meeting of the Liverpool Chemists' Association, specimens of lead-pipe and sheet-lead, electro-plated with tin, were exhibited by Mr. Holt, and some discussion ensued respecting the use of lead coated in this manner for water-cisterns and pipes. It appeared to be the opinion of the meeting that the coating of tin, instead of preserving the lead, was far more likely to ensure its more rapid corrosion; for if the coating of tin by any means happened to be scratched off, even to the slightest extent, galvanic action would take place, and the lead would be destroyed very quickly. Dr. Nevins and Dr. Edwards stated that their experiments had proved that such would undoubtedly be the case; Dr. Edwards remarking that, in one case which he had examined, a cistern made of lead, in which was an accidental admixture of tin, was eaten out by well-water in six months, the lead being rapidly precipitated in the form of sulphate, &c.

A very important decision was come to at the Telegraphic Congress held last week at the Foreign Office, Paris. The concession of a trans-Atlantic submarine cable to M. Balestrini, sanctioned by all the Powers represented at the conference, was formally ratified. The plan is to connect Europe with the Brazils, and the Brazils with North America, so that a despatch from Paris to New York will have to go round *via* Pernambuco. The scheme is a grand one, and its boldness deserves success, but the difficulties in the way of its practical realisation seem formidable in the extreme.

An invention by Mr. Oliver, chief engineer, for preventing the screw from falling after the upper paul is above deck, has been approved by the Admiralty, and ordered to be fitted to the "Orlando." This invention is likely to prove of advantage on board all screw steamers. The "tell-tale," for informing the officials in the engine-room of the direction of the vessel, also invented by Mr. Oliver, has been fitted in the "Orlando."

MM. Delouche and Fellman, an artist and an engraver, have introduced a new method of engraving, which presents many features of interest. They take a plate of polished zinc, which they cover with a coating of whiting analogous to, but not identical with, that employed by wood-engravers; upon this the design is drawn with a peculiar ink. The plate is then suspended in a bath of sulphate of copper from the negative pole of an ordinary galvanic battery, where the inked portions of the drawing become coated with a deposit of copper. When this is considered sufficiently thick, the plate is removed, and having been washed, is suspended from the positive pole of the same battery in a bath of acidulated water. The acid eats into the plate where it is not covered with copper, or the white part of the drawing. A few hours terminate an operation which supplies a plate from which ordinary engravings may be taken in the usual way.

A miniature breech-loading cannon, upon a new principle, the invention of Mr. L. W. Broadwell, of New Orleans, was tried recently at Woolwich, in the experimental range, and gave satisfactory results. The chief recommendations of the new gun are the simplicity of its breech-loading arrangements and the substantial method on which it appears to be constructed, proved by the severe tests to which it was subjected. The gun, when constructed on larger dimensions, is expected to prove a most serviceable weapon. No training is required to initiate the gunner, the method of loading being simply the removal and replacing of a small block of iron to receive the charge. There is a self-acting expanding ring, which serves to seal the breech hermetically at the moment of discharge, and which does not impede the movement of the vent-piece. The projectile used is an elongated shot, simple and plain in construction.

Petroleum for preserving Wood.—The oil wells near Prome, in Burmah, have been in use from time immemorial. Wood both for shipbuilding and house-building, is invaribly saturated or coated with the product of those wells. The result is entire immunity from decay, and the ravages of the white ants that in that country are so generally destructive. M. Crepin, a Belgian Government engineer, who has tried experiments upon the relative advantages of creosote and sulphate of copper for the preservation of timber in marine constructions from the attacts of worms, &c., says that creosoting is the only process he has found to succeed for this purpose. He states that sulphate of copper affords no protection whatever against the action of salt water and marine insects. The Belgian Government now require that all the wood sleepers used in the State railways should be creosoted; and the Government of Holland have also made the same resolution; and upwards of 300,000 sleepers per annum are now being creosoted by the Dutch Government, and more by the Belgian Government.

Wilkinson's Rotary Printing Press.—*Macniven and Cameron's Paper Trade Review* gives a description of this new printing machine, which, it says, will print at least twice as fast as any now used. It will throw off with ease twenty thousand sheets an hour, printed on both sides, cut and folded, ready for immediate delivery. The process of printing with this machine may be described briefly as follows:—The paper being made of the proper width for the sheet intended to be printed, is wound upon a shaft in one continuous piece, in the same form as an ordinary roll of carpeting, and, at the same time, is damped so as to enable it to take a perfect impression. The type, which is slightly conical in form, is placed upon the surfaces of two cylinders, the circumferences of each of which is exactly equal to the length of the newspaper to be printed. Each type is made in the precise line of the radius of the cylinder on which it is placed, and a small projection on one side of the type, with a corresponding indentation on the other, furnishes a means of locking the type together on the surface of the cylinder, so that it is impossible to displace them by the most rapid rotary motion. The machine being set in motion by any ordinary power, the paper is unwound from its shaft by the action of an endless apron, by which it is carried forward and introduced between the first type cylinder and corresponding press roller, where the impression on one side the paper is made. After this first impression, the paper is still carried forward in a direct line, and immediately passes between the second type cylinder and press roller, by which the impression is made on the reverse side. The sheet being now printed on both sides, is still carried forward into the apparatus by which it is folded, and at the precise point when the folding process is completed, a heavy standing shears, by a single blow, separates it from its original roll, and it drops upon the floor a printed newspaper, ready for immediate distribution.

Important Tests of Wire Rope.—Some tests of wire rope took place on Wednesday last week, at the public chain-testing works, Birkenhead, under the superintendence of Mr. Macdonald. The experiments were made for the purpose of testing the wire rigging lately supplied to Messrs. T. Vernon and Son for the new ship "Robert Lees," belonging to Messrs. Liston, Young, and Co., Liverpool. The wire was the manufacture of Garnock, Bibby, and Co. The pieces submitted for testing were as follows:—One piece of galvanized charcoal, 5 in., stood a strain of 36 tons 15 cwt.; the Admiralty test being 32 tons 5 cwt. One piece of galvanized charcoal, 4¾ in., stood a strain of 33 tons 2 cwt.; the Admiralty test being 28 tons 6 cwt. Other ropes from the same manufacturers were also tested, with the following results:—A piece of 4 in. steel stood a strain of 38 tons; a sample of 2¼ in. BB. (or second quality) stood a strain of 7 tons; a sample of 2¼ in. BB. (or second quality) stood a strain of 8 tons 7 cwt.; being in each instance considerably over the Admiralty test for charcoal rope. It is necessary to state that the cores of the above samples were all made of hemp, and not wire, as is now much used; had they been made with wire cores the tests would have been, by estimation, 5 in. charcoal wire rope, a strain of 49 tons; 4¾ in. ditto ditto, 42 tons 16 cwt.; 4 in. steel ditto, 48 tons 13 cwt.; 2¼ in. BB. ditto, 9 tons 14 cwt.; 2¼ in. ditto ditto, 8 tons.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 3073, 3049, 3067.
Boilers and Furnaces, 3042.
Ships and Boats, including their fittings, 3007, 3025, 3061, 3065.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3018, 3051, 3063.
Cultivation of the Soil, including agricultural implements and machines, 3014, 3031.
Food and Beverages, including apparatus for preparing food for men and animals, 3026, 3032, 3035, 3062.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 3009, 3013, 3015, 3016, 3022, 3023, 3028, 3034, 3045, 3046, 3052, 3053, 3056, 3060.
Buildings and Building Materials, 3039, 3050.
Lighting, Heating, and Ventilating, 3027, 3041, 3058, 3066.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 3019, 3020, 3024, 3029, 2033, 2036, 3040, 3047, 3057, 8364.
Metals, including apparatus for their manufacture, 3008, 3043, 3055.
Chemistry and Photography, 3017, 3021, 3044.
Electrical Apparatus—*none.*
Warfare, 3005, 3012, 3038, 3054.
Letter-Press Printing—3004.
Miscellaneous, 3003, 3306, 3010, 3011, 3030, 3048, 3059.

3003. T. Goodyear. *A machine for plaiting straw and such like material.* (A communication.) Dated November 6, 1862.

This machine consists of a roller having a number of curved projections thereon, which roller, through the medium of a winch handle, receives a partial rotation, whereupon certain rods and levers come into operation and effect the plaiting of the straw. *Patent abandoned.*

3004. W. E. Gedge. *An improved lift and force pump.* (A communication.) Dated November 6, 1862.

The pump forming the subject of this invention presents the following advantages:—One, two, three, ten, twenty, or as many pipes or tubes as desired, may be adapted to it. Each tube is isolated, and works separately. It sucks and forces without a reservoir, without valve, and without piston, and works constantly and with the greatest rapidity when provided with water. The air is sucked in by means of rollers or cylinders which press the tubes, and the vacuum fills with the liquid in which the extremity of the tube plunges. This pump is composed of the cylinder or pump barrel, the interior of which is furnished with several pipes or tubes of caoutchouc, leather, or other suitable material. These tubes follow the cylindrical form of the barrel, but do not go completely round, and they come to the exterior one end in the liquid and the other forming the jet end of the pump. Through the centre of the cylinder passes a shaft, supporting in the interior of the cylinder a couple of plates, which sustain three small rollers or cylinders with their pivot on the thickness of these plates. On giving motion to the shaft by means of a crank, the three rollers placed at equal distances apart execute the same movement, likewise turning on their pivot, and it is in accomplishing this movement that they press against the tubes fitted in the pump barrel, and cause the apparatus to work. Another very simple method of action is as follows:—The suction and force pipes or tubes are placed all around the cylinder, their ends issuing to the exterior at the same place, some entering the liquid and the others conducting the jet. A single roller is retained and is fixed to the shaft by two branches, which may be lengthened or shortened by press screws, so as to press the roller against the tubes as much as desirable. *Patent abandoned.*

3005. B. T. U. Monin. *Improvements in breech-loading firearms.* Dated November 6, 1862.

Here the object is to facilitate the rapid loading and discharging of firearms. The invention consists in using and removing a sliding key, which, when removed, opens an aperture leading from the bore of the gun to the butt end or stock. This butt end contains a recess fit to contain several cartridges, which are brought forward by an endless belt or chain running on two rollers. The shaft of one of these rollers carries a pinion, which is actuated by a tooth wheel loose of the shaft of the cock. When the cock is moved back, a catching spring-hook causes the wheel to move, whilst, when firing, the same wheel remains motionless. The whole motion is given by the finger bearing on the trigger; the cock by its back motion not only causes the chain to move and to bring forward the cartridge, but a lifting cam carried by its shaft removes the key, the latter carries along a connecting-rod, which causes a sliding piece to push forward a cartridge into the breech of the barrel, and a spring brings the key to its place, and the gun is ready to be fired off. *Patent abandoned.*

3006. H. Griffin. *An improved method of securing india-rubber cylinders or rollers and blocks upon spindles and other bodies upon which they are to be mounted.* Dated November 6, 1862.

This invention consists in first coating or clothing the spindle or other body on which india rubber is to be mounted with a composition of india rubber for forming what is known as ebonite or hard rubber, and in then adding on such composition to complete the article to the thickness required ordinary or pure india rubber, or rubber known as cut sheet rubber (that is to say, sheets of rubber cut from a solid block), or rubber prepared for being vulcanised. He then subjects the spindle or other body, with its clothings of prepared or hard rubber composition, and ordinary or other rubber as before mentioned, to heat, in order to "cure" the composition. When the curing has been effected, the ordinary or other rubber will be securely held on the spindle or other body through the cured or hard rubber which itself becomes securely fixed to the spindle or other body. *Patent completed.*

3007. W. N. Hutchinson. *Improvements in apparatus or means for protecting the screw of steamers from becoming entangled with or fouled by ropes or other bodies.* Dated November 6, 1862.

This invention consists in the employment of a flexible screen or net on each side of the quarter or after part of the ship, and both fore and aft of the screw, hanging nearly vertically, composed in the upper part of several folds of strong waterproofed canvas, or other suitable material or materials, and partly sustained in the water by corks, or a spar of light wood. The remainder of the screen may be a net (chain or otherwise) of large meshes, say 18 inches wide (made of metal or other suitable material), which, being thin, offers little resistance to the sea, and therefore is not liable to be injured by a sea striking it, nor to impede the ship's progress. In ships with fine rims, the patentee prefers to form the whole screen of net made with Newall's galvanised wire rope. *Patent completed.*

3008. J. A. Fullarton. *Improvements in machinery or apparatus for painting or coating hoop iron and other strips, bars, rods, or other such articles of metal, wood, or other material.* Dated November 6, 1862.

This invention refers to that description of machinery in which rotary brushes are employed, and consists in an arrangement whereby the articles are successively presented to the painting or coating apparatus, and in such manner that a portion of each of such articles may remain unpainted. The invention cannot be described without reference to the drawings. *Patent completed.*

3009. M. A. F. Mennons. *Improvements in the manufacture of paper.* (A communication.) Dated November 7, 1862.

These improvements consist—1, in the addition to paper pulps of albumen, gluten, serum, or other analogous substances, coagulable by heat. 2, in the application to the surface of the manufactured paper of one of these substances, either alone or in combination with coloured or colourless powders of different descriptions. The object of these processes is to produce a glazed paper or cardboard for general printing and photographic purposes, applicable in certain cases as paper hangings, which, being thus coated with a transparent and insoluble matter, may be readily washed or otherwise cleaned at will. The albuminous matter is incorporated with the pulp by any convenient means, the remaining processes of manufacture being carried out in the usual way. The coating of the manufactured paper may be effected either by immersion in a bath of the albuminous matter, or by simple brushing of the latter over the surface. The paper thus treated is then dried and glazed in the ordinary manner. *Patent abandoned.*

3010. C. O. Heyl. *Improved means and machinery to be used for the purpose of extracting fatty oils from oleaginous seeds, and for purifying the said oils, and for extracting the agents employed from the exhausted residue.* Dated November 7, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3011. W. Clark. *Improvements in the means of utilizing refuse and azoted matters of commerce.* (A communication.) Dated November 7, 1862.

The inventor claims—1, the employment of alkaline sulphurets, and especially those of sodium and potassium, for dissolving the azoted matters, either in the open air or under pressure, and also the separation by means of this agent of wool from cotton or other thread in certain cases. 2, he claims the commercial application of the solubility of the said azoted matters in sulphuric acid, either in the open air or under pressure, and the employment of the said acid while saturated with azoted matters for the production of acid phosphate of lime. 3, he claims the saturation of the said acid phosphate of lime with animalized alkaline sulphurets, and also the combination of these reactions in order to produce manure containing azote in various forms, alkaline phosphates, and hydrated phosphate of lime. 4, he claims the direct application of animalized superphosphate obtained by the action of the acid, saturated with azoted matters on the phosphates, in the manner specified. *Patent completed.*

3012. A. V. Newton. *Improvements in repeating firearms.* (A communication.) Dated November 7, 1862.

This invention relates to a modification of certain of the working parts of repeating firearms. The hammer and the trigger are operated by a combination of the main-spring and the scre-spring, which are united at the ends that are fastened to the stock. The main-spring works on the hammer by means of a swivel, and causes the blow of the hammer. The hammer is thrown back by the scre-spring acting on the trigger, and thence through an arm of a forked lever. The rotating cylinder containing the cartridges is made to revolve by means of a flexible arm of the forked lever. This flexible arm works into ratchet teeth cut on the rear end of the cylinder. In its return motion it is free to slide over the teeth, and when in action it pushes round the cylinder so as to bring the next cartridge before the hammer. A small arm is attached to and projects forward from the hammer, and at every blow of the hammer is forced into one of a series of holes in the rear end of the cylinder for the purpose of holding the cylinder firm during the discharge. Fixed ammunition is used in the firearm, and the blow of the point of the hammer, or of a pin held by a spring, discharges in succession the metallic cartridge, whether of pistol, rifle, or carbine. *Patent abandoned.*

3013. T. Greenwood and J. Schofield. *Improvements in mules for spinning and doubling.* Dated November 7, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3014. J. H. Johnson. *Improvements in decorticating grains and seeds.* (A communication.) Dated November 7, 1862.

This invention relates to a chemical process for decorticating grain and seeds of all kinds, in substitution for the mechanical processes hitherto adopted for this purpose. According to this invention, it is proposed to treat the grain or seeds to be decorticated by subjecting the same to the action of acids or alkalies, or acid or alkaline compounds (assisted or not by heat), for the purpose of destroying the outer skin or pellicle adhering to grain and seeds of all kinds, without injuring the kernel of the grain or seed itself, for which purpose also the chemicals employed should be used in a semi-fluid or viscous state. *Patent abandoned.*

3015. H. Gardner. *Improvements in machinery for treating flax and other fibrous materials preparatory for manufacturing purposes, the said machinery being also applicable for pressing, rolling, grinding, pulverizing, or mixing various other substances.* Dated November 8, 1862.

This invention consists of a fluted roller mounted on a frame or carriage; on the top of this roller the patentee places one or more smaller rollers, either fluted or smooth; these rollers are carried and supported on a bell crank, which works on the same centre as the large roller, and this bell crank is driven by means of a crank shaft, which revolves in suitable bearings, and works in slots in the arms of the bell crank, which gives a reciprocating motion to the bell crank, and therefore to the rollers. These rollers are kept in contact with each other by springs, which are regulated by set screws, whereby any required pressure may be given on the material to be operated upon. On the crank shaft is a pinion which drives a counter wheel and pinion, which turns on a pin attached to the side of the frame which works into another wheel keyed on the shaft of the large roller. The pin which carries the counter-wheel and pinion is moveable in slots in the side of the frame, whereby wheels or pinions of larger or smaller diameter may be used, so as to give greater or less speed to the roller, and thus increase or diminish the rubbing or crimping process on the material passing between the rollers. The material to be operated upon is led between the said rollers by feeding cloths or otherwise, as most convenient. When it is required for other purposes than fibrous materials, he makes use of smoothed, turned, rough, or ribbed rollers. The main principle to be observed is, that the gearing introduced should be to effect a slow motion of the large roller, while that of the oscillating frame is much quicker; thus, while the large roller is slowly travelling and carrying with it the fibre or other substance to be operated upon, the oscillating frame moving with greater velocity will cause the smaller roller to travel backwards and forwards on the material many times before the portion immediately in contact with them is carried away by the larger or lower roller. The different rates of speed of the larger and smaller set of rollers will, therefore, be regulated according to the material operated upon, and the effect to be produced. *Patent completed.*

3016. H. Kilshaw and E. Lord. *Certain improvements in power looms for weaving.* Dated November 8, 1862.

This invention relates to that part of the power loom known as the tappets, secured upon the tappet shaft, and employed for actuating the healds, and consists in the peculiar form of tappets to be employed for causing the back healds to rise together and fall lower than the front ones, and whereby an improvement is effected on the surface of the cloth. The invention cannot be described without reference to the drawings. *Patent completed.*

3017. G. H. Ogston. *Improvements in treating nitrous acid and nitric oxide, in order to convert them into nitric acid.* Dated November 8, 1862.

The object of this invention is to recover certain oxides of nitrogen generated in various processes, often treated as waste products, and allowed to escape into the atmosphere, to the great injury to the health and vegetation of the neighbourhood in which such operations are conducted. For instance, nitric oxide and nitrous acid occur as waste products in the manufacture of oxalic acid, by the action of nitric acid upon sugar. The operation being usually conducted either in open vessels or in imperfectly constructed apparatus, the whole of the nitric oxide generated is thrown into the atmosphere and lost. Now, in order to render the nitric oxide so generated available for the reproduction of nitric acid, the patentee effects the decomposition of the saccharine matter in a close vessel of a construction described. In this improved apparatus he causes the nitric oxide, together with any other oxides of nitrogen by which it may be accompanied, to pass through a series of vessels, which he calls condensers, so arranged as to subject these gases to the simultaneous action of compressed air and water, or the vapour of water. He regulates the pressure and temperature, as may be required from time to time as the operation proceeds. *Patent completed.*

3018. C. W. Spruyt. *Improvements in rails for railways.* Dated November 8, 1862.

This invention consists in forming rails in two parts—the foot, the web, and a shoe in one piece, and the top in another piece. The top is shrunk bolted, or otherwise attached to the shoe, and when worn it can be removed, and another top may be fixed on the same shoe. The invention also consists in inserting between the shoe and the top a layer of lead, hardened rubber, or other material softer than iron. *Patent completed.*

3019. W. Simpson. *Improvements applicable to letter-boxes and other like receptacles.* Dated November 8, 1862.

We cannot here give space to the details of this invention. *Patent completed.*

3020. G. L. Locke and J. Clark. *Improvements in the motive mechanism of pianofortes.* Dated November 8, 1862.

This invention refers to the construction of that part termed the hopper, or its equivalent in grand pianos termed the jack, that is, the part secured to the inner end of the keys which in upright instruments serve to act upon the lever to which the sticker is attached, which sticker acts upon the hammer-butt or end. These improvements are intended to attain more perfect action, to afford more power to the blow of the hammer, and greater facility of regulating. This hopper consists of a base firmly secured to the end of the key, this base having a projecting part (termed the fork), with a recess at its end, in which recess is fitted a straight piece, termed the "fly of the hopper," part of which is below and part above the sides of the said recess or fork, to which sides the fly is centered upon a pin free to move. The part of the fly below has the regulator button acting upon it, and this button is secured on the end of a screw-pin that passes into the base of the hopper. The upper part of the fly has the wire spring adjusted at back thereof, such spring being secured to the back of the upper part of the said fly. *Patent abandoned.*

3021. E. Sonstadt. *Improvements in the manufacture of the metal magnesium.* Dated November 8, 1862.

These improvements in the manufacture of the metal magnesium relate—1, to the manner of preparing magnesia or its carbonate, so that it may be in a suitable state for the obtainment from it of magnesium by the process described. 2, to the preparation of an anhydrous compound containing magnesium, chlorine, and sodium, from which magnesium may readily be obtained either by electrolysis of the fused material, or by its reaction with sodium. 3, to the use of iron vessels in which to effect the reduction of magnesium from the said material by means of sodium. 4, to the preparation of an anhydrous chloride of magnesium, and the use thereof for the separation of sodium from metallic magnesium. *Patent completed.*

3022. G. Kent and E. P. Griffiths. *Improvements in apparatus for reducing cocoa berries and other vegetable and animal substances to powder or pulp, and for mashing potatoes.* Dated November 8, 1862.

For the purposes of this invention, a cylindrical vessel is by preference used, though the form of the upper part of this vessel may be varied. At the lower part of this vessel there is formed a bottom or horizontal partition, composed of angular blades, the cutting edges of which radiate from a circle at the centre to the outer circumference of the vessel. The cutting edge of each of these blades or cutters is so formed and fixed in respect to the back edge of the next angular blade, as to come slightly above the back edge of, the next blade; hence, when the nibs or broken parts of the roasted cocoa berries are, as is hereafter explained, driven round against the cutters, they will be cut, and the fine cuttings or powder thus produced will pass through between the spaces where the cutting edges of the cutters overlap, or rise above the back edges of the neighbouring blades. In the central plate of the horizontal partition or bottom above mentioned, is a bearing for an upright shaft or axis, on which is fixed an instrument consisting of several inclined projections, the lower surface of each of which comes in contact or nearly so with the radial cutting edges of the angular plates above described. Such lower edges of the inclines do not radiate from the centre of the axis or shaft, but are at an angle to the cutting edges of the blades; hence, when the axis of the shaft is caused to rotate, the inclined projections from the shaft will cause the nibs, or the separated parts of the cocoa berries, to be carried round by the inclines, and by them will be pressed against the cutting edges of the fixed angular blades. When the apparatus is to be employed in reducing bread or other vegetable substance, or to mash potatoes, or to reduce animal matter which has been pounded or beaten in a mortar or otherwise, a bottom is introduced into the vessel constructed of woven wire gauze in place of the angular blades. The upper part of the axis turns in a bearing in the centre, carried by a frame consisting of three radial arms, which have hook-formed ends, which respectively pass under legs or projections at the upper edge of the vessel. *Patent completed.*

3023. J. and T. Mellodew and C. W. Kesselmeyr. *Improvements in looms for weaving.* Dated November 8, 1862.

This invention refers to the apparatus for making the shed of looms. To effect this operation the patentees use two elements, the one consisting of a tappet or series of tappets, and the other of a pattern chain or equivalent apparatus; the latter of which determines whether the tappets shall be "risers" or "sinkers." The invention cannot be described without reference to the drawings. *Patent completed.*

3024. G. H. Sanborn. *An improved wringing machine.* Dated November 10, 1862.

This invention consists in the arrangement or combination of the different parts of a wringing machine; in the means of adjusting the rollers of the same; and in the mode of adjusting the machine to the tub or washing vessel. The frame of the machine consists of two posts connected at the top by a cross-piece, and below the rollers by rods or other convenient means. The shaft of the lower roller to which the power is applied rotates in boxes fixed firmly in the posts, while the boxes containing the bearings of the upper roller shaft move up and down in grooves or channels in the posts to adapt the space between the rollers of various descriptions. The machine is rendered self-adjusting by means of two pieces or rolls of india rubber, or other suitable material, resting on the moveable boxes, and kept in place by means of a spring bar. The ends of this bar rest upon the india-rubber rolls or pieces, and the pressure upon it is varied as required by an adjusting screw through the top cross-piece. This screw bears upon the centre of the spring bar, thus permitting either end of the said spring bar, and, consequently, either end of the upper roller, to yield independently to the pressure caused by the fabrics passing through the machine. The lower end of each post is forked, or a slit is cut therein sufficiently wide to receive the side of the tub or washing vessel, and also a binding piece or clamp. These clamps are secured to the sides of the posts by means of guide-pins on which they move freely. The machine having been placed on a tub or washing vessel, the clamps are pressed upon the sides thereof by means of set screws, which set screws pass through the same side of the posts as the guide-pins, and secure the machine firmly without injuring the sides of the said vessel. *Patent abandoned.*

3025. E. Connell. *Improvements in constructing ships or vessels.* Dated November 10, 1862.

This invention relates more particularly to the class of ships or vessels constructed with iron or steel frames and external wood planking, and is designed to admit of such planking being fastened by means of copper, yellow metal, or composition bolts or fastenings, in such a way as not to be liable, or so liable as hitherto, to the corrosive action which has been experienced where copper, yellow metal, or composition bolts or fastenings have been used along with iron frames. It is where the bottom planking of the ship is fastened to the "floors," or floor frames, that liability to corrosion has been principally experienced, on account of the pressure internally at that part of bilge water; but, by the present invention, such liability is avoided, or considerably reduced, by fixing or fastening the copper, yellow metal, or composition bolts or fastenings of the planking into beams or floors of wood, such wooden floors being themselves fixed or fastened to the iron or steel floors by iron or steel bolts or fastenings. If desired, this system of fastening may be extended more or less above the floors, and it may be applied to other constructive details of the same or other classes of ships or vessels. *Patent abandoned.*

3026. J. Whitaker. *Improvements in machinery or apparatus for pulping, stripping, and slicing edible roots for cattle.* Dated November 10, 1862.

Instead of employing two separate machines for pulping, slicing, and stripping, or changing several parts of the same machine, the patentee performs all the operations in one machine, and uses a hinged guide or plate to lead the roots to either side, as may be required. He fixes to the driving shaft at each side of the machine a plain wheel, one mounted with one or more knives for slicing, and the other with the knives or tools for pulping. The stripping knives or tools are fixed upon separate plates, which, when required, are screwed to the slicing wheel, there being slots in the wheel to allow the tools to pass through the interior. The hinged guide or plate is placed in the centre of the hopper, and can be turned on either side, so as to guide the roots to the pulpers on one of the wheels, or to the slicing knives or strippers on the other wheel, by which means the three operations of pulping, slicing, and stripping can be performed at different times in the same machine. The runs of the wheels turn in grooves formed by beads in the sides of the hopper, in order to enable the knives or tools to be quite close to their work, and, thereby, slice, strip, or pulp the last piece; and the sides of the hopper are curved and sloped to allow the matters to be delivered from the machine with perfect ease. *Patent completed.*

3027. J. B. Lavoine. *A kitchen range, called "Cuisiniere Lavoine," adapted for cooking, warming the apartments, and generating gas for the use of private families, hotels, or gentlemen's country seats.* Dated November 10, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3028. S. Berrisford and W. Ainsworth. *Certain improvements in looms for weaving.* Dated November 10, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3029. R. R. Holmes. *Improvements in folding chairs and seats.* Dated November 10, 1862.

For the purposes of this invention, on each side of a seat or chair, or at each end of a longer seat, two bars are applied, which cross each other at a point above the seat. These bars are connected together by a pin joint, which will admit of their being both folded together one on the other, and also of their being opened out one from the other, so as to form legs or supports for the seat; and according as the two legs at each side or end of the seat are at any time at a greater or less distance apart, so will the seat be nearer or more distant from the floor or ground. The two bars above mentioned forming the frame at each side or end of the seat are of different lengths above the pin joint, which constitutes their axis of motion. The shorter bar is formed with an elbow, whilst the longer bar is arranged to carry a back, which it is preferred should turn on a neck or axis, and have a certain degree of play, so that the person sitting in a chair may, when leaning against the back, cause the inclination of the back to assume a position most agreeable to the sitter. The seat is below the point at which the two bars are connected, and the seat is attached by a pin joint or axis to the bar which carries the elbow. At each side or end of the seat there is a rack formed or applied, and connecting the two longer ends or supports. At the opposite sides or ends of the chair there is a bar upon which the rack fits, so as to retain the legs or supports from opening or spreading when once the chair or seat is put into a desired position, and there is an india-rubber spring used tending to fold the two bars together when the rack is lifted up or released from the bar. *Patent completed.*

3030. R. J. Chapman. *Improvements in the manufacture of glass and emery paper or cloth.* Dated November 10, 1862.

Hitherto, the powdered glass and emery dust have been sprinkled or sifted on to the adhesive solution spread on the paper or cloth on one side only, but the inventor proposes by this invention to apply the adhesive solution to both sides or surfaces of the paper or cloth, and to sprinkle thereon the powdered glass, or the corn emery, or flour emery, according to the coarseness or fineness of the article required, so that he produces a double surface, each suitable for rubbing wooden bodies, and imparting smoothness and lustre thereto. *Patent abandoned.*

3031. J. Shanks. *Improvements in mowing machines.* Dated November 10, 1862.

This invention relates more especially to that class of machines used for mowing or cutting short grass and vegetables or plants, commonly known as lawn-mowing machines, and it consists—1, in dispensing with the ordinary cutter bracket, with the screw for raising it up and down, and in the substitution therefor of an eccentric brass or other bush, fitted into the frame of the machine. This eccentric bush is fitted with a slotted flange, and, by merely turning it round, the cutter or actual mower is raised or lowered as may be desired, according to the direction of the turning. 2, in the placing or attaching a flap or pendent end to the grass box of the machine when fitted to a delivery apparatus. This arrangement is so fitted that when the travelling end is at one end of the box, the flap at the other end is down, and this part opens when the travelling end begins to move. *Patent completed.*

3032. W. E. Newton. *Improvements in the treatment of maize or indian corn preparatory to grinding the same into flour.* (A communication.) Dated November 10, 1862.

Here the maize is first steeped in a bath of cold water containing a given weight of carbonate of soda in solution. On removal from this bath, the granular matters are submitted to a second steeping in a bath of cold water containing a given weight of hydrochloric acid. The grain is now dried, crushed, or flattened by suitable apparatus, and submitted to the action of a special bolting apparatus, the seives of which are graduated in fineness. We cannot here quote the whole process in detail. *Patent completed.*

3033. J. Easton and J. C. Amos. *Improved machinery for sawing wood.* Dated November 10, 1862.

In carrying out this invention, in order to secure the log from rising with the drag of the saw on its bed while being cut, the patentees keep it drawn down by means of pressing rollers or bowles, carried by vertical water cylinders, in which stationary pistons are inserted, their rods being pendent from a transverse beam of the saw frame. The upper and lower ends of each cylinder are brought into communication by an outside pipe, which allows of the water which fills the cylinders to pass from one side to the other side of the fixed pistons. The water forms an elastic packing between the piston and the lower ends of the cylinder, and serves to retain the bowles of the cylinders in contact with the timber when once lowered in contact therewith. *Patent completed.*

3034. T. G. Ghislin. *Improvements in the treatment of certain foreign plants, and in the application of the fibres derived therefrom.* Dated November 10, 1862.

This invention relates to the treatment of the following South African plants, their families and species, viz.:—Oxalidæ, Hibiscus and other Malvaceæ, Virgilia, Bryonia, Gnaphalium, Ficoideæ, Salicornia, Euphorbiaceæ, Urticeæ, Ficus, Proteaceæ, Cycadeæ, Phœnix, reclinata Indeæ including Watsonia humilis and others, Gladiolus, Antholyza, Lapyronsia, Barbiana, Witsenia, Tritonia, and Sparaxis Juncaceæ Serratus and Tristra; various Resticeæ Cyperaceæ and Gramineæ Holcus, Saccharatus, Maize, and Stipa. By treating these plants according to the special process described, the patentee is enabled to obtain useful fibres of various characters or qualities, which may with advantage be applied to such purposes as hemp, flax, cocoa fibres, hair, and whalebone have hitherto been employed. *Patent completed.*

3035. G. F. Lyster. *Improvements in apparatus for elevating or otherwise transmitting grain and other granular substances.* Dated November 10, 1862.

This invention has for its object the elevating or otherwise conveying of grain and other similar substances from one locality to another in a more expeditious and convenient manner than has heretofore been effected, and consists in the employment of strong currents or blasts of air for that purpose, which currents of air are conducted through tubes to the locality whence the grain or other substance is to be removed, and are there caused to pass into the open ends of other tubes or channels, which open ends are immersed in the grain or other substance, so that the air, on rushing into such tubes, is caused to drag with it the grain or other substance surrounding the orifices, and to propel it along inside the conducting tubes or channels with the requisite velocity for raising it to a certain height, or for conveying it to a certain distance. *Patent completed.*

3036. G. Davies. *Improvements in the construction of crinoline skirts.* Dated November 11, 1862.

In manufacturing these crinoline skirts, the hoops are furnished at suitable distances with a small tape, having a button-hole, which fixes on a corresponding button sewn on the petticoat. Each of the hoops is thus retained by a certain number of buttons (or hooks and eyes may be substituted), and to remove them it is only necessary to unbutton or unhook them. *Patent abandoned.*

3037. W. Booth, J. Booth, and T. Booth. *Improvements in rotary engines.* Dated November 11, 1862.

This invention consists in constructing rotary engines, in the cylinders of which a piston or pistons connected to a central shaft is or are made to revolve by steam, water, air, or other fluid. The patentees adapt a sliding partition to the cylinder by means of levers or otherwise. The steam or other fluid may be cut off from the cylinder at certain periods, to allow it to work expansively. *Patent completed.*

3038. W. Palliser. *Improvements in the construction of ordnance, and in the projectiles to be used therewith.* Dated November 11, 1862.

This invention consists in forming the barrel of concentric tubes of different metals, or of the same metal differently treated, so that as nearly as possible, owing to their respective ranges of elasticity, when one tube is on the point of yielding, all the tubes may be on the point of yielding. It thus differs essentially from the method hitherto prevalent, of equalizing strains on concentric tubes by placing an initial or permanent strain on the external ones. *Patent completed.*

3039. H. Burridge. *Improvements in the construction of fire-proof buildings, and a ready method of extinguishing fires in the same, and in other buildings, warehouses, and shipping.* Dated November 11, 1862.

This invention consists in employing a service pipe or pipes connected to and communicating with one or more perforated pipes or tubes, arranged in the form of a framework or otherwise, and extending under the ceiling, the whole length and breadth of such ceiling, and across it. The patentee recommends that the perforations in the pipes be formed in their upper and lateral sides. The said service pipe is also connected to and communicates with a hose, attached, as desired, to a supply of water. *Patent completed.*

3040. J. J. Parkes. *Improvements in lever bell-pulls.* Dated November 11, 1862.

This invention relates, principally, to that class of lever bell-pulls used in sitting-rooms, and usually let into recesses in the walls, and consisting of a circular box, more or less ornamental on the exterior, from which a lever handle projects. In ordinary this lever acts on a barrel winding up a chain, which pulls the wire, and so rings the bell. Instead of the chain connection, the patentee applies a crank arm and pin on the axis of the lever handle, or the crank pin may be on the lever handle itself. The crank pin takes upon a lever, to the end of which the bell wire is attached. The wire lever he makes as long as may be necessary, and equal to the full diameter of the box; or it may be beyond that limit if a suitable fulcrum be provided. By making this lever of such length, the arc that it describes is but very slightly curved, and serves to give almost a straight pull on the wire, and sufficiently near a right line for the purposes required. The pull of the bell spring and wire serves to bring the lever bell-pull back to position after pulling the bell as usual. A suitable groove is made in the crank pin to receive the edge of the wire lever, which keeps it in position sideways, for which reason it may be mounted very loosely on its fulcrum. He constructs the several parts of this apparatus so that the box may be fixed to the wall, and all of the parts of the pull applied thereto subsequently with great facility one after the other. *Patent completed.*

3041. E. Marriott and S. Holroyd. *Improvements in the purification of gas, and in obtaining certain useful products therefrom.* Dated November 11, 1862.

In purifying gas, the patentees use a combination of sulphate of iron with ammonia; and in carrying out this part of the invention, they take ammoniacal gas liquor, and add a solution of iron, so as to precipitate all the sulphides, and leave a slight excess of iron. This excess, however, must not be sufficient to neutralize all the ammonia present, but must leave the solution with a decided alkaline reaction. The quantity of iron to be added will vary with the composition of the gas liquor, but the fact of all the sulphides having been precipitated will be readily ascertained by test in the usual manner. The solution thus obtained they use by pumping it continuously through the ordinary gas scrubbers, but as the iron will become decomposed during the process of purification, small quantities must from time to time be added. The necessity for such addition may be ascertained by the character of the gas as it passes off; if it be foul, more iron is then required, just after the same manner as the condition of the ordinary lime purifiers is ascertained. Secondly, the invention consists in treating the gas with sulphide or sulphuret of iron, and this necessarily takes place in carrying out the first part of these improvements. The invention, however, also consists in the use of sulphide or sulphuret of iron derived from other sources for purifying gas, either in the wet or the dry way. *Patent completed.*

3042. W. Harper. *Improvements in the construction of steam boilers and other furnaces.* Dated November 12, 1862.

The object of this invention is to increase the combustion of smoke, and the manner of accomplishing this is as follows:—The bridge of the furnace, instead of being of solid brickwork, as now customary, is made of perforated blocks of fire brick, or other suitable material; and, instead of leaving a passage for the smoke between the top of the bridge and the under side of the boiler or flue, the bridge is built up to the under side of the boiler or flue, thus causing the smoke to pass through the perforations above referred to; and, as the blocks in which the perforations are made are heated by the fire of the furnace, it is evident that the smoke, in passing through the perforations, becomes ignited, and it is thus advantageously disposed of, instead of making it escape to the chimney. In some cases a bridge of the ordinary construction may be used in combination with the perforated bridge. *Patent abandoned.*

3043. W. and J. Galloway. *Improvements in machinery or apparatus for cutting, shaping, punching, and compressing metals.* Dated November 12, 1862.

This invention has reference to a previous patent of the year 1859, No. 526. The patentees claim, firstly, the application of preparatory rams for pushing the metal down into the dies, and, in some cases, for partially performing the operation upon them, which is to be completed by the finishing rams, substantially as described. Secondly, surrounding the dies upon the die tables with water for the purpose of keeping them cool. Thirdly, the employment of a steel bed plate on the top of the die tables, upon which the dies rest, so as to prevent injury to the die tables. Fourthly, fixing down the dies on to the die tables, in the manner described. Fifthly, the mechanism described for actuating the step by step rotary motion of the die tables. Sixthly, the arrangement described for regulating the exact extent of motion of the die tables. Seventhly, the arrangement described for actuating the cutting levers for cutting off the lengths of metal. Eighthly, the combination of any one or more of the various improvements described as constituting the present invention with the machinery or apparatus for cutting, shaping, punching, and compressing metals, as described in the specification, to the hereinbefore mentioned letters patent granted to James Howden, in the year 1859. No. 526. *Patent completed.*

3044. G. Smith. *Certain improvements in obtaining colouring matter.* Dated November 12, 1862.

In obtaining colouring matter according to this invention, the inventor mixes suitable proportions of nitric acid and aniline, that is, any preparation in which the latter exceeds the former. He then heats the mixture, and adds thereto arsenious acid, until it becomes of a rich red or purple colour. And the colouring matter so produced, when dissolved, can be used for dyeing or printing. What he claims as the invention is the treatment with arsenious acid of the mixture produced by heating nitric acid and aniline together. *Patent abandoned.*

3045. W. Dobson. *Improvements in apparatus used in dressing lace or other fabrics.* Dated November 12, 1862.

This invention consists in the employment of a spindle of any required dimensions, and arranged in a convenient manner, having within itself a series of rollers, each roller revolving on the spindle. By the use of a spindle thus constructed, the starch or "dress" may be imparted to the lace in a more regular and equal manner than by the means heretofore employed, besides effecting a saving of time and material. *Patent abandoned.*

3046. C. Socin. *Improvements in looms for weaving ribbons.* Dated November 12, 1862.

This invention consists in a novel construction and arrangement of shuttle frame and shuttles, according to which the guide grooves for the shuttles and the shuttles are curved in a circular line, by means of which considerable economy of space is effected, and other advantages are obtained. *Patent completed.*

3047. T. Bradford. *An improved clothes' wringer and mangler; the acorn wringing and mangling machine, applicable to pressing the liquid from clothes in the process of washing and other pressing purposes.* Dated November 12, 1862.

In carrying out this invention the patentee employs a spring of wood, or other suitable material, consisting of a bar having one or more slots sawn or slotted in it from each end to as near the centre as may be found desirable, similar to a music tuner with one or more tongs. In these slots, when required, he inserts sheet india rubber of suitable thickness, and in the centre or solid part of the bar or spring he makes a hole, through which is passed the plain or unscrewed part of a compressing screw, having the head or knob of an acorn shape, the bottom part of which is loose upon the shank for anti-frictional purposes. The shoulder of the head or knob presses upon the bar or spring, and the worm or thread is received in a nut held in a cross stay fixed to either wood or metal framework, and which, on account of its convenience and utility, is specially adapted to washing, wringing, and mangling machines. By turning the screw with the acorn head or knob inwards, the ends of the spring bar are compressed to any required degree upon T head bolts, forming the communication between the ends of the spring bar and the journals of the upper roller for wringing or liquid pressing purposes, when such rollers are made or covered with india rubber, or other elastic material, and also for various other purposes, such as calendering, when the rollers are made of wood, or other suitable material. The great advantage of the improved spring bar consists in its yielding or reciprocating to the various inequalities of the articles required to be operated upon. *Patent completed.*

3048. F. J. Clowes. *An improvement in obtaining rotary motion.* Dated November 12, 1862.

This invention consists in substituting a cam or cams fixed on a straight shaft in lieu of cranks, as at present in use, and running the ends of such shafts in bearings in the following manner:—In the first place the cam is grooved on its outer periphery, in order to receive a strap or chain which works round a pulley in the lever of the treadle. Secondly, the patentee runs the ends of such shafts in friction boxes; the friction wheel or wheels at either end may be also grooved in order to receive an elastic band, which may be of any flexible substance. This combination is equally applicable to lathes, sewing machines, or, in fact, to any machine in which rotary motion is obtained by treadle action. *Patent completed.*

3049. J. Faulding. *Improvements in locomotive engines.* Dated November 12, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3050. J. H. Thomson. *Improvements in machinery or apparatus for finishing and dressing tiles and similar articles of clay.* Dated November 12, 1862.

Under one modification or system of arrangement, this machine consists of an open rectangular framing formed of wood, or other suitable material. On the middle longitudinal rails of the framing are arranged the pedestal blocks and bearings of a transverse horizontal shaft, which is driven from a steam engine, or other prime mover. A pinion on the end of this shaft gives motion to a wheel which is fast to a second shaft, parallel to the driving shaft, and nearer to the end of the framing. At each end of this shaft, but inside the framing, is fitted a pulley, and the two are connected together by transverse bars, so as to form an open drum. A corresponding arrangement is fitted at the other end of the machine, and round the two is carried an endless band or traversing platform, on which the article to be finished and dressed is laid. The endless band is formed of links of metal of a rectangular figure, connected to each other by transverse pins, or arranged in any other convenient manner. To the links of this chain metal slabs are bolted, on the surface of which the plastic material is laid. A few only of these slabs are used for laying on the plastic material, and these slabs are each fitted with a back bracket piece or stop, which prevents the clay from being carried off the slab by the action of the dressing and finishing apparatus. This consists of a pair of A shaped standards, which are bolted down to the top rail of the framing, and are connected by a transverse tie rod. One of the angular faces of each standard is slotted, so as to admit of fitting thereto an adjustable tool, which is somewhat similar to a plane iron in its action. A mass of the clay or plastic material having been laid on one of the slabs fitted with the back piece, as the endless chain moves forward, the plastic material is cut to a uniform thickness, and at the same time dressed and finished by the action of the dressing tool. Meanwhile the workman places another supply of clay on the next operating slab, and in this way the manufacture of tiles, fire clay, flue covers, furnace blocks, and other generally similar articles proceeds with great rapidity. The dressed and finished articles are carried forward to the other end of the machine from whence they are removed in any convenient manner. At the back of each operating slab the contiguous slab of the chain is omitted, so that the refuse clay removed by the dressing tool falls through the aperature thus provided on to a shoot beneath. By shifting the dressing tool up or down, tiles or slabs of any required thickness may be readily made. *Patent abandoned.*

3051. J. A. Duntze. *Improved apparatus for communicating rotary motion to shafts or axles for various purposes.* (A communication.) Dated November 12, 1862.

This invention relates to various improvements upon an invention for which letters patent have been granted to William Austin Ashe, bearing date the 28th day of March, 1862, No. 863. According to Mr. Ashe's invention, a driver, stud, pin, or tooth, which is connected with the piston of a steam engine, is caused to work in a groove cut in or secured to the shaft to be driven, and which passes through the steam cylinders. It has been found that causing the propeller shaft to pass through the steam cylinder is sometimes inconvenient, inasmuch as the shaft, when it passes through the piston, requires packing, which cannot be got at with facility. The present invention obviates this inconvenience, and (supposing the improvements be employed to drive the propeller shaft of a steam vessel), the steam cylinders are to be placed alongside the propeller shaft, which is, consequently, outside the steam cylinders, and the pistons or piston rods of such cylinders are made to communicate a reciprocating motion to the drivers or stud pins, which are caused to reciprocate in a double helical groove cut in or secured to the shaft, and by this means communicate a rotary motion to the shaft. *Patent completed.*

3052. A. Graemiger. *Improvements in looms.* Dated November 12, 1862.

This arrangement consists in arranging a jacquard apparatus in a loom, in such a manner as to cause the shuttle-box to rise and fall, in place of making it raise and lower the threads of the warp. *Patent completed.*

3053. A. Twaddell. *Improved arrangements for dressing or sizing warps.* Dated November 13, 1862.

This invention consists in so arranging machinery for dressing or sizing warps; that temporarily separated portions of the warps may be independently dressed or sized, and be combined with the rest of the warps before or when passing upon the drying cylinder. *Patent completed.*

3054. G. W. Rendel. *Strengthening and hardening cannon made wholly or partially of carbonized iron or steel, or the barrels or other parts thereof.* Dated November 13, 1862.

In carrying out this invention, the inventor brings the cannon, or the parts of cannon, to a suitable heat in an oven, or any convenient furnace, and he then plunges them into a bath of oil, or other liquid; or, instead of plunging the cannon, or parts of cannon, he pours the liquid over them. To keep down the temperature of the liquid—which is raised in the act of cooling the cannon, or the parts thereof—he employs pipes winding through the liquid, in which pipes a current of cold water circulates, or the liquid may be cooled by any other suitable arrangement; but any arrangement for the cooling is not essential to the process of strengthening, being only a matter of convenience, as having the effect of reducing the volume of liquid necessary for cooling large masses of metal. *Patent abandoned.*

3055. G. W. Rendel. *Strengthening armour plates made of carbonized iron or steel.* Dated November 13, 1862.

In carrying out this invention, the inventor brings the plates to a suitable heat in an oven, or any convenient furnace, and he then plunges them into a bath of oil, or other liquid; or, instead of plunging the plates he pours the liquid over them. To keep down the temperature of the liquid—which is raised in the act of cooling the metal—he employs pipes winding through the liquid, in which pipes a current of cold water circulates, or the liquid may be cooled by any other suitable arrangement; but any arrangement for cooling is not essential to the process of strengthening, being only a matter of convenience, as having the effect of reducing the volume of liquid necessary for cooling masses of metal. *Patent abandoned.*

3056. T. C. and J. Eastwood. *Improvements in machinery or apparatus for combing wool or other fibrous substances.* Dated November 13, 1862.

This invention consists in the employment of a series of combs, each mounted upon a stem or arm, constructed or formed so as to be capable of sliding in a continuous groove or groves of suitably formed framework, and carrying the combs into contact with ordinary feeding heads or nipping rollers, which supply wool or other fibre to be combed. The said combs detach tufts therefrom in succession, the ends of which tufts are cleansed by card surfaces. The combs, when thus supplied with fibre and cleansed at the projecting ends, are caused to travel forward and turn on their stems or arms, so that the combs are in succession placed end to end with each other, thus forming a continuous travelling comb or chain comb, from which the fibre is drawn off in sliver by ordinary drawing-off rollers, and the wool removed by the usual means. The combs thence pass forward in the circuit, and again turn on their stems, assuming their former position before coming into contact again with the feeding heads, from which they receive another supply, and so on continuing to circulate in the groove or grooves of the frame. *Patent abandoned.*

3057. J. Stack. *Improvements in nursery swings and cots.* Dated November 13, 1862.

This invention has for its object improvements in swings, swing chairs, beds, cots, and other similar articles for nursery, house, or other use, and for recreation and other purposes, whereby the same are rendered self-acting, or capable of maintaining the motion imparted to them for a considerable time, without domestic or other superintendence. The improved swings are made in a portable form, and these, as well as the cots and other articles, when required, can be fitted with spring or other power, to give the starting-motion. The motion thus or otherwise imparted, is rendered self-maintaining by the improved and counterbalancing principle of construction described in the specification. *Patent completed.*

3058. M. Defries. *Improvements in the manufacture or construction of lamps.* Dated November 13, 1862.

The patentee claims the combination of an earthenware pedestal or stand with an earthenware reservoir, each being manufactured in separate parts, forming, when the reservoir is fitted to the pedestal, and the burner to the reservoir, an improved lamp for paraffin and other oils, as described. *Patent completed.*

3059. W. E. Gedge. *An improved machine, working by compression and expansion of air.* (A communication.) Dated November 13, 1862.

This invention is not described apart from the drawings. *Patent abandoned.*

3060. R. and P. Sykes. *Improvements in rings used in machines for the continuous spinning, doubling, and twisting of wool and other fibrous materials.* Dated November 13, 1862.

This invention relates to the manufacture of the rings used in substitution for the ordinary flyers employed in machines for spinning, doubling, and twisting wool and other fibrous materials; and consists—1, in making such rings of malleable cast iron, and afterwards hardening the same by the agency of heat, the same being used in the same manner and for the same purpose as the glass rings described in the specification of letters patent granted to the present patentees on the 27th day of January, 1860, No. 208. 2, in varying the form of the said rings from that represented and described in the specification of the patent above referred to, so as to dispense with the bead or rounded projection on the inner side, at the upper part thereof, which bead is intended to prevent the ring flyer from leaving the ring during its rotation. *Patent completed.*

3061. E. S. Ritchie. *Mariners' compass.* Dated November 13, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3062. G. Davies. *Improvements in preserving provisions.* (A communication.) Dated November 13, 1862.

This invention consists in causing a current of electric fluid to pass through the cases containing the provisions after they are finally closed up. The electric fluid is made to pass along a fine iron or other metallic wire through the case, which causes the wire to become red hot and consume the oxygen. A further improvement consists in placing inside the case (and in connection with the thin wire) any known chemical agent (such as common sulphur, for instance) which, in its ordinary state, has no particular affinity for oxygen, but which, upon becoming ignited, by means of the electric wire above referred to, evolves any gas (sulphurous acid gas, for instance) which will absorb, destroy, or convert into a harmless gas the oxygen which is contained in the case, and which it is desired to get rid of. *Patent abandoned.*

3063. R. A. Brooman. *An improved means or apparatus for shunting trains.* (A communication.) Dated November 13, 1862.

The object of this invention is to enable a train to be shunted or moved from one line of rails to another without the aid of an attendant. The invention consists in fitting to the front or side of locomotives, tenders, or carriages in front of a train, a projecting rod or rods, which comes or come in contact with a weighted lever or levers at the side of the rail, which, through the medium of rods or chains, draw the points together, and cause the course of the train to be diverted. *Patent completed.*

3064. E. Joseph and J. Danks. *Improvements in brushes, brooms, and mats.* Dated November 13, 1862.

These improvements relate to means of combining hair, cocoa nut, or other fibre into the forms desired for the production of brushes, brooms, and mats. For this purpose, the inventors first weave or otherwise combine the fibres to be used into a sort of fringe. They then apply to the back or combined edge of this fringe a solution of shellac, or other suitable cement, and they then fold or lay the fringe so produced with the back or combined edge thereof in layers together, leaving the front or loose ends thereof free. A convenient method of obtaining the forms desired is to begin at the centre, folding the fringe round and round upon itself to the desired size. They then apply a solution of marine glue or other adhesive matter to hold the parts together, and a back of flexible or other material, according to the purpose to which the brush, broom, or mat so produced is to be applied. *Patent abandoned.*

3065. C. G. Kopisch. *Improved apparatus for propelling, steering, and ventilating vessels.* Dated November 13, 1862.

This apparatus may be described as a furnace contained within, and extending from end to end of, an elongated horizontal steam boiler, below which is situated an air reservoir. The reservoir is supplied with air by a pumping or blowing engine of any ordinary or suitable construction, which air the patentee proposes to draw from the hold of the ship, and bring the various cabins into communication by air pipes, for the purpose of effecting their ventilation. This pumping engine is to be worked by a steam engine, supplied with steam from the steam boiler. The air reservoir is brought into connection with the ash-pit of the furnace by pipes, which supply air under pressure to the fire-place. The furnace is connected at its rear end with a chimney, by two openings of different diameters, both of which are capable of being easily closed. From the furnace also lead off air trunks, the outer ends of which open into and below the surface of the water. These trunks serve to conduct columns of air rearwards, and direct them into the water; and it is by the pressure of these columns of air upon the water that the ship is propelled in any desired direction. *Patent completed.*

3066. E. S. Cathels. *Improvements in the apparatus used in the manufacture of gas.* Dated November 14, 1862.

We cannot here give space to the details of this invention. *Patent completed.*

3067. E. B. Wilson. *Improvements in the method of conveying air, steam, gases, and fluids to oscillating or vibrating cylinders and vessels, and in the apparatus employed therein.* Dated November 14, 1862.

This invention relates to a peculiar mode of forming the connection of a steam, blast, or other pipe with an oscillating or vibrating vessel or cylinder. As an example of the application of this invention, in lieu of the ordinary method of conveying air to the atmospheric converting vessels oscillating on trunnions employed in the manufacture of iron and steel—namely, by passing such supply of air through the trunnions of the same, it is proposed to bring the blast-pipe centrally with, but disconnected from, the trunnions or centres on which the vessel turns, and as near to the same as may be convenient, at the end of which pipe a suitable connecting joint is made, that will allow the pipe to revolve freely, such pipe being in the form of a radial arm, and connected at the other end with the atmospheric vessel. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated March 9, 1863.

648. H. A. Bonneville, 24, Rue du Mont Thabor, Paris, A new aromatic vinegar for removing stains from cloths and other materials. (A communication.)

Dated May 2, 1863.

1108. H. Myers, 55, Rue Meslay, Paris. A new apparatus for indicating appointments or fixed engagements.

Dated May 9, 1863.

1169. E. R. Clark, Drayton Villa, Thistle-grove, West Brompton. An improvement in the construction of portable wine cases or bins for domestic use or export and a pic-nic chest combined.

1169. N. Legendre, 89, Chancery-lane. Improvements in the construction of scissors.

Dated May 12, 1863.

1192. W. Whiteley, Prospect Iron Works, Lockwood, York, iron and brass founder and machinist. Improvements in looms for weaving.

1197. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in machinery for preparing, dressing, and winding cotton, woollen, flax, silk, and other warps. (A communication.)

Dated May 13, 1863.

1200. H. Wilde, Manchester, engineer. Improvements in electro-magnetic telegraphs.

Dated May 15, 1863.

1226. J. Patterson, Beverley, engineer. Improvements in machinery or apparatus for grinding, crushing, cleaning, and hulling or shelling various kinds of farm or vegetable produce, also applicable to the crushing or grinding of minerals and other substances.

Dated May 16, 1863.

1228. R. W., W., and T. Waddington, Thornton-road, Bradford, machine comb makers. Improvements in combs for combing wool by machinery.

1229. B. Browne, 49, King William-street, City, civil engineer. Improvements in the manufacture of elastic material. (A communication.)

1239. J. Whitehead, Calverley, near Leeds. Improvements in motive power machinery, especially adapted for raising and forcing water and other liquids or fluids, parts of said improvements being applicable to steam engines and other machines fitted with pistons.

Dated May 18, 1863.

1241. W. Watson, Clipstone-street, Fitzroy-square, bread and biscuit baker. Improvements in the manufacture of bread and in apparatus used for the same.

1243. A. Heather, Devonshire-house, Southsea, Hants, and J. Redfern, Cumberland-road, Southsea. Improvements in the construction of steam boilers for marine, locomotive, and stationary engines.

1244. B. Hebblewhite, Kingston-upon-Hull, draper. Improvements in machinery or mills for crushing or reducing oil cake, seeds, and other substances. (A communication.)

1245. R. Fenner, envelope manufacturer, and W. H. Hight, engineer, Red Lion-court, City. Improvements in envelope folding machines.

1247. J. Beaumont, Moate, Westmeath, scribbling engineer. Improvements in condensing machines for working yarns of wool and other fibrous substances.

Dated May 19, 1863.

1248. C. Barnard, J. B. C. Barnard, jun., and G. Barnard, Norfolk Iron Works, Norwich, engineers. Improvements in lawn mowing and rolling machines.

1249. S. Rhodes, Farnworth, Bolton, builder. Improvements in machinery for twisting and doubling cotton, hemp, flax, and other like fibrous materials.

1250. J. Edwards, 29, Basinghall-street. Improvements in the permanent way of railways.

1253. R. Bunting, Sheffield, cutler. Improvements in frames, tips, and bolsters used in cutlery, and in securing handles or scales therein or thereto.

1254. H. J. Olding, Belvidere-road, Lambeth, engineer. Improvements in treating flax and other fibrous plants in order to prepare the fibres thereof for spinning, and in apparatus employed therein.

1255. J. Kelly, Brook Lodge, Ireland, civil engineer. Improvements in the preparation or treatment of peat or turf and the manufacture thereof into charcoal and other fuel, drain pipes, building and other tiles, and in apparatus used therein.

1257. L. Chandor, New York, gentleman. An improved mechanical lamp.

1259. L. Chandor, New York. An improvement in lamps.

1260. W. Smith, Mauchline, Ayr, gentleman. Improvements in transferring plain or coloured prints or designs to wood or other surfaces.

Dated May 20, 1863.

1261. H. Wren and J. Hopkinson, London-road Iron Works, Manchester, mechanical engineers. Improvements in the construction of self-lubricating bearings for shafts and axles.

1263. W. J. C. Lang, Kirkcudbright, Scotland, gentleman. Improvements in the manufacture of certain articles to be used for preserving life at sea and other purposes.

1265. R. R. Jackson, Blackburn, cotton spinner and manufacturer, and W. Pemberton, loom overlooker. Improvements in looms for weaving.

1267. J. T. Markall, Fieldgate-street, Whitechapel. Improvements in machinery for working of wood.

Dated May 21, 1863.

1268. J. Cassell, La Belle Sauvage-yard, Ludgate-hill. Improvements in the treatment of mineral oils and hydrocarbons. (A communication.)

1269. G. R. Harding, Wandsworth. Improvements in the means of transmitting power on railways worked by vacuum or the pressure of air, and in the apparatus to be employed for such purpose.

1271. J. Steart, 5, James's-road, Bermondsey, manufacturer. Extracting the fibre from zostera marina and other aquatic vegetable productions.

1275. N. J. Amies, Manchester, small ware manufacturer. Certain improvements in the manufacture of elastic webbing.

1277. W. H. Clapp, North-place, Ball's Pond-road. An improved rail or holder for coats or other articles.

1279. J. Fawcett, Huddersfield, cattle food manufacturer. Improvements in the preparation of food for cattle, horses, and orher animals.

Dated May 22, 1863.

1283. C. Maschwitz, Birmingham, merchant. Improvements in stoppers or bungs for closing or stopping bottles, jars, and other vessels, and the muzzles of rifles, and for other like purposes. (A communication.)

1284. T. A. Blakely, Montpelier-square. Improvements in ordnance.

1285. J. J., J. M., and M. H. Habershon, Rotherham, York, rolling mill proprietors. Improvements in machinery for rolling, polishing, straightening, and tapering round rods or bars of iron, steel, and other metals.

1286. T. A. Blakely, Montpelier-square. A new method of rifling guns, and of forming projectiles to correspond therewith.

1287. G. Stevens, Victoria-terrace, Camberwell. Improvements in coke ovens, and in building and heating ovens or retorts for generating coal gas connected therewith.

1288. W. E. Newton, 66, Chancery-lane, civil engineer. Improvements in the manufacture of waterproof fabrics. (A communication.)

1289. W. E. Newton, 66, Chancery-lane, civil engineer. Improved machinery for the manufacture of waterproof fabrics. (A communication.)

1290. J. Higgins, machine maker, and T. S. Whitworth, manager, Salford. Improvements in machinery or apparatus for roving, spinning, and doubling cotton and other fibrous materials.

1291. A. W. Hofmann, Fitzroy-square, Professor in the Royal College of Chemistry. Improvements in preparing colouring matters for dyeing and printing.

Dated May 23, 1863.

1294. J. A. Pickering, Heath-cottage, Oatlands Park, professor of music. Improvements in covers or capsules for bottles, jars, and similar vessels.

1295. W. Cormack, Manchester, chemist. Improvements in the distillation of coal tar, tar oil, resin, resin oils, all hydro-carbons, petroleum, or other mineral or vegetable oils and spirits derived therefrom.

1296. S. E. Rosser, Northumberland-street, Strand, warming and ventilating engineer, and J. G. Jennings, Palace-road, Lambeth, sanitary engineer. Improvements in chimneys, fire-places, stoves, and flues, for warming and ventilating apartments.

1297. J. S. Bickford and G. Smith, Tuckingmill, Camborne, Cornwall, safety fuze manufacturers. A certain new manufacture for firing explosive compounds.

1298. W. Hoey, Great George-street, Bermondsey, tanner and currier. The preparation of a fluid for renewing the surface of japanned and enamelled leathers and cloths.

1299. J. Hopkins, Chapel-street, New Basford, Nottingham, lace maker. Improvements in points and in crossings used on railways and on tramways.

1302. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in the manufacture of bells, and of resisting and non-cutting tools. (A communication.)

1303. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in safety garments. (A communication).

1305. G. Smith, Fenchurch-street, merchant. Improvements in lamps for burning hydro-carbon oils. (A communication.)

Dated May 25, 1863.

1306. J. Hesford, Cunliffe-street Works, Bolton, millwright and engineer. Improvements in machinery and apparatus for stretching and drying cotton and other fabrics or materials.

1307. W. Muir, Britannia Works, Manchester, engineer and machinist. Improvements in machinery for cutting sugar, and for assorting the lumps when cut.

1309. H. A. Bonneville, 24, Rue du Mont Thabor, Paris. Improvements in the construction of carriages. (A communication.)

1310. P. Leprovost, London street, Paris, civil engineer. Certain improvements in carriages and vehicles for railways and other roads.

1311. E. Hunt, Glasgow, patent agent. Improvements in posts or pillars for fences and gates. (A communication.)

1312. G. Köttgen, Barmen, Prussia, manufacturer. An improved binding to be used for trimming woollen cloth garments.

1313. H. B. Girard, 11, Rue du Conservatoire, Paris, chemist. Improvements in the heating of every industrial and private apparatus by means of the oxygen and hydrogen gases combined and obtained from the decomposition of water.

1314. T. Spurrier, Moseley, Worcester, gentleman. Improvements in the manufacture of ornamental metal cylinders.

1316. C. Hare, Norwich, chair manufacturer. Improvements in reclining and easy chairs.

1317. R. Hayward, Wapping, wine cooper. Improvements in apparatus for bottling liquids or for drawing or letting off at the same time liquids from several different casks or vessels.

1320. W. Clark, 53, Chancery-lane, engineer. Improvements in apparatus for ruling paper and other materials, either alone or in combination with typographical or lithographical printing. (A communication.)

Dated May 26, 1863.

1321. A. Haley, Frome, Somerset, machinist. Improvements in jacquard looms.

1322. J. Munro, Tillanburn, and R. Scott, Cambusnethan, Lanark, engineers. Improvements in apparatus for boring, mining, and excavating, or cutting; in motive power engines; and in pressure gauges.

1323. E. K. Dutton, Stretford, mechanical engineer. Certain improvements in apparatus, called "gins," for cleansing seed cotton.

1324. M. Henry, 84, Fleet-street, patent agent. Improvements in apparatus for raising, forcing, and moving fluids. (A communication.)

1325. J. Buckingham, Launceston, Cornwall. Improvements in ploughs.

1327. W. E. Newton, 66, Chancery-lane, civil engineer. Certain improvements in machines for separating the fibre from the flesh of plants. (A communication.)

Dated May 27, 1863.

1329. W. Clark, 53, Chancery-lane, engineer. Improveprovements in offensive and defensive arms. (A communication.)

1330. A. Bastow, Bradford, York, manufacturer. Improvements in looms for weaving.

1331. H. C. Coulthard, Park Ironworks, Blackburn, engineer. Improvements in blast engines.

1332. H. J. Kennard, 36, Great George-street, Westminster. Improvements in the construction of wrought-iron cylinders for piers or piles to bridges, viaducts, or for other foundations or structures where the sinking of cylinders is required.

1333. C. Gammon, 9, Cloak-lane, City, gentleman. An improved spring fastening.

1334. W. Palliser, Capt. 18th Hussars, Dublin. Improvements in projectiles for ordnance.

Dated May 28, 1863.

1336. W. I. Ellis, Vulcan Foundry, near Warrington, engineer. Improvements in steam boilers.

1338. G. Gore, Birmingham, consulting chemist. Improvements in gas burners and in gas furnaces.

1340. H. Cartwright, Dean Broseley, Salop, gentleman. Improvements in apparatus for steering vessels.

1342. T. Richardson, Newcastle-upon-Tyne, chemist, and R. Irvine, Musselburgh, Mid Lothian, manufacturing chemist. Improvements in treating the waste liquor obtained in the preparation of esparto grass.

1344. T. H. White, Piccadilly, accoutrement maker. Improvements in hats, caps, and other coverings for the head.

1346. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in paddle wheels. (A communication.)

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated May 28, 1863.

1341. C. F. Baxter, Boston, U.S. A new and useful hollow elastic stopper for bottles, jugs, and other similar vessels.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, June 9, 1863.

237. W. Rollason. Metallic boxes.

247. E. F. Prentiss and J. C. Sellars. Treating oil.

248. J. Oglesby, and J., W. M., and J. Dickinson. Steaming, cooking, and generating gas.

249. H. O. Cook and E. G. Terry. Propelling ships and vessels.

251. B. Ward. Printing surfaces.

255. S. W. Francis. Revolving shutters.

258. C. P. Stewart and J. Robinson. Giffard's injector.

283. W. E. Gedge. Hair nets. (A communication.)

286. T. Bennett. Obtaining pictorial backgrounds, foregrounds, and perspectives.

304. J. Fletcher and H. Bower. Feeding boilers with water.

305. A. T. Blakely and J. Vavasseur. Ordnance.

310. J. Mellor. Distilling, subliming, and drying.

316. L. J. H. Marville. Covering for the ears.

321. J. A. Manning. Treatment of night soil.

324. J. Gill and J. Parkin. Polishing yarn, twine, threads, and other similar materials.

330. R. A. Brooman. Tuning pianofortes. (A communication.)

334. A. Johnson. Propulsion of vessels.

345. G. Turner. Mincing or cutting meat and other substances.

354. B. Dobson and E. Barlow. Carding engines. (A communication.)

357. D. Law and J. Downie. Traction engines.

366. J. F. Bottom. Dressing fabrics.

376. R. A. Brooman. Photographic apparatus. (A communication.)

392. W. Robertson. Spinning and doubling.

408. W. Clark. Separating the fibres of straw, wood, and other vegetable substances, and extracting the gummy and colouring matters therefrom. (A communication.)

437. D. Tassin. Preventing the explosion of steam boilers.

467. W. Clark. Boilers. (A communication.)

468. W. Clark. Projectiles. (A communication.)

507. E. R. Walker. Valves.

514. W. Clark. Sewing machines. (A communication.)

518. R. Maynard. Chaff-cutting machines.

552. E. T. Hughes. Doubling or twisting yarn. (A communication.)

644. W. E. Newton. Metal casks. (A communication.)

706. T. Powell. Chopping-block.

791. N. R. Hall. Weighing apparatus.

929. R. Reeves. Manufacture of liquid manure drills.

1009. R. Richardson. Railway permanent way.

1047. H. E. Carchon and E. F. Raybaud. Manufacture of hats and bonnets.

1073. H. Y. D. Scott. Cementitious substances.

1168. E. R. Clark. Portable wine cases or bins.

1192. W. Whiteley. Looms.

1200. H. Wilde. Electro-magnetic telegraphs.

1210. T. Lawrence. Drying, dressing, brushing, waxing, and finishing fabrics.

1248. C., J. B. C., jun., and G. Barnard. Lawn mowing and rolling machines.

1256. A. Parker. Saving from destruction by fire persons and property in houses, buildings, and ships, and also for ventilating ships. (A communication.)

LIST OF SEALED PATENTS.

Sealed June 5, 1863.

3286. R. A. Brooman.
3307. W. Inglis.
3313. D. Chalmers.
3317. E. Toynbee.
3318. I. Spight.
3367. A. Albini.
3452. W. Clark.
3455. J. Swainson.

Sealed June 9, 1863.

3322. R. Clark.
3330. J. Gaskell and H. Walmsley.
3338. E. Thorold.
3339. C. Corbet.
3392. S. G. Lister.
3397. W. L. Longridge.
3429. S. Russell.
3442. R. Lakin and J. Wain.
3453. C. F. Varley.
3477. J. E. Carter.
81. W. H. Moreland and J. Chappell.
99. W. E. Newton.
256. W. Clark.
308. W. E. Newton.
412. J. Morgan.
501. G. Davies.
654. Sir A. Keller.
717. G. De Laire.
765. T. G. Grant.
1020. R. Lavender.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1357. C. W. Lancaster, J. Brown, and J. Hughes.
1373. C. Senior.
1386. F. H. Wenham.
1388. C. Stevens.
1391. C. Hadfield and W. A. Attkins.
1394. W. McI. Cranston.
1406. M. Jacoby, J. Redgate, and J. Stones.
1408. G. A. Waller.
1410. G. Kane.
1412. A. A. Croll.
1425. J. Combe.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1310. E. Marsden.
1358. W. E. Wiley.
1387. J. Combe.
1468. G. Gurney.
1473. H. H. Vivian, B. G. Herrmann, and W. Morgan.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending June 6, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2900	0	6	2917	0	4	2934	1	8	2951	0	4	2968	0	10	2986	0	4
2901	0	4	2918	1	8	2935	0	8	2952	1	6	2969	1	0	2987	0	8
2902	0	4	2919	0	4	2936	0	4	2953	0	8	2970	1	2	2988	0	10
2903	0	4	2920	0	4	2937	0	8	2954	0	10	2971	1	10	2989	1	0
2904	0	4	2921	1	4	2938	0	8	2955	0	10	2972	0	6	2990	0	4
2905	0	4	2922	0	8	2939	0	8	2956	1	4	2973	0	8	2991	0	4
2906	0	4	2923	0	4	2940	1	6	2957	0	6	2974	0	8	2992	0	4
2907	0	10	2924	0	4	2941	0	4	2958	0	10	2975	0	4	2994	0	8
2908	1	0	2925	0	4	2942	0	6	2959	0	10	2977	0	10	2995	0	8
2909	0	8	2926	1	0	2943	0	4	2960	0	4	2978	0	4	2996	0	4
2910	2	10	2927	0	4	2944	0	4	2961	0	10	2979	0	10	2997	0	4
2911	0	4	2928	0	10	2945	1	10	2962	0	8	2980	0	4	2998	0	8
2912	1	6	2929	0	4	2946	0	8	2963	0	10	2981	0	10	2999	0	4
2913	0	4	2930	2	0	2947	0	4	2964	0	4	2982	0	4	3000	0	4
2914	0	4	2931	0	8	2948	0	10	2965	0	10	2983	0	10	3001	1	0
2915	0	4	2932	0	4	2949	0	8	2966	1	0	2985	0	6	3002	0	8
2916	0	4	2933	0	4	2950	3	6	2967	0	4						

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-bdgs, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	p ct.
IRON:—									
Welsh Bars, in London	per ton	6	10	0	to	0	0	0	2½
Nail Rods	do	7	0	0		7	5	0	
Hoops	do	8	10	0		8	15	0	
Sheets, single	do	9	10	0		9	15	0	
Staffordshire Bars	do	7	10	0		8	0	0	
Bars, in Wales	do	5	10	0		5	17	6	
Rails	do	5	10	0		6	0	0	nett
Foundry Pigs, at Glasg, No 1	do	2	10	6		2	15	0	
Swedish Bars	do	11	10	0		12	0	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		0	0	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	96	0	0		0	0	0	3
Hammered Bottoms	do	106	0	0		0	0	0	
Flat Bottoms, not Hamrd	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	8½	
Fine Foreign	per ton	94	0	0		95	0	0	
TIN:—									
English Block	per cwt.	6	2	0		0	0	0	2½
do Bar	do	6	3	0		0	0	0	
do Refined	do	6	8	0		0	0	0	
Banca	do	6	12	0		0	0	0	nett
Straits	do	6	7	0		6	10	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	8	6		1	9	6	
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
LEAD:—									
Pig, English	per ton	20	12	6		23	0	0	2½
,, Spanish Soft	do	19	17	6		0	0	0	
Shot, Patent	do	23	15	0		0	0	0	
Sheet	do	21	10	0		0	0	0	
White	do	27	0	0		0	0	0	
SPELTER:—									
On the spot	do	18	0	0		0	0	0	nett
ZINC:—									
English Sheet	do	23	5	0		0	0	0	2½
QUICKSILVER	per btl.	7	0	0		0	0	0	3

TIMBER, duty 1s. per load, drawback 1s.

	£	s.	£	s.
Teak ... load	£12	0	£13	0
Quebec, red pine	3	10	4	10
,, yellow pine	3	10	4	10
St. John, N.B., yellow	0	0	0	0
Quebec oak, white	5	10	6	10
,, birch	3	10	4	10
,, elm	3	10	5	0
Dantzic oak	3	10	6	10
,, fir	2	10	3	10
Memel fir	3	5	3	10
Riga	3	0	3	5
Swedish	2	10	2	15
Masts, Quebec red pine	5	0	6	0
,, yellow pine	5	0	6	0
Lathwood, Dantzic, fm	5	10	6	10
,, St. Petersburg	8	0	8	10
Deals, perC., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				
Quebec, white spruce	15	10	18	10
St. John, white spruce	14	0	15	10
Yellow pine, per reduced C.				
Canada, 1st qual.	17	0	18	0
,, 2nd do.	11	0	12	0

	£	s.	£	s.
Archangel, yellow	£13	0	£13	10
St. Petersburgh, yel.	11	10	12	0
Finlan	9	0	10	0
Memel	10	0	15	0
Gothenburg, yellow	10	0	11	0
,, white	9	0	9	10
Gefle, yellow	10	10	11	10
Soderhamn	9	10	10	10
Christiania, per C., 12ft by 3 by 9 in.				
Christiania, yellow	21	0	23	0
Deck Plank, Dantzic, per 40 ft. 3 in.	0	14	1	4
PUMICE STONE pr ton	5	10	9	8
OILS, &c.				
Seal, pale ...per tun	48	0	0	0
Sperm body	82	0	83	0
Cod	80	0	0	0
Whale, Sth Sea, pale	48	0	0	0
Olive, Gallipoli	59	0	60	0
Cocoanut, Cochin	49	0	50	0
Palm, fine	37	0	0	0
Linseed	45	0	0	0
Rapeseed, Eng. pale	49	0	50	0
Cottonseed	33	10	42	0

THE MECHANICS' MAGAZINE.

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The *Daily Telegraph* of March 31st, in its description of Benson's Great Clock, says: "it is a triumph of ingenuity." —Benson's new show-rooms contain clocks designed by the first artists of the day, and include clocks for the drawing-room, dining-room, bedroom, library, hall, staircase, bracket, carriage, church, turret, railways, warehouse, counting-house; with musical, astronomical, and every description of clock, from the plainest to the highest quality of which the art is at present capable. Church and turret clocks specially estimated for. Benson's illustrated pamphlet on clocks and watches (free by post for two stamps) contains a short history of clock and watch making, with descriptions and prices; it acts as a guide in the purchase of a clock or watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world, to select a clock.—J. W. Benson received a Prize Medal and Honourable Mention. 33 and 34, Ludgate-hill, London. Established 1749.

TO INVENTORS AND PATENTEES.
MESSRS.
ROBERTSON, BROOMAN, AND CO.,
Civil Engineers
AND PATENT AGENTS
(Established 1823),
166, FLEET STREET, LONDON.
UNDERTAKE TO OBTAIN PATENTS FOR INVENTIONS,
PROVISIONAL PROTECTIONS
APPLIED FOR.
Specifications Drawn and Revised.

THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JUNE 19, 1863.

STEAM ON COMMON ROADS.

Some inventions spring at once into public favour; others creep into it at a snail's space. The introduction of steam as a means of locomotion on our highways seems to follow the latter rule. Just a century ago, the first locomotive with regard to which we possess any reliable data, was constructed by Louis Cugnot. The success of this little machine was sufficiently great to demonstrate the fact that animal power was no longer necessary to locomotion. Long after Cugnot came Handcock, Gurney, Dance, and many others, who constructed steam omnibuses and carriages of various kinds with more or less success; and having each developed some novel principle or contributed some new fact, have died, and, with their engines, sunk into comparative oblivion, leaving the subject, as far as general adoption goes, to all intents and purposes as little advanced as they found it. Once more revived, some few years ago, it has since received sufficient attention to warrant the expectation that at last fair progress was really being made. The Patent Office again became the receptacle of invention after invention, all having for their object the development of the comparatively new principle. Government roused itself; the necessity of traction engines to the economical working of dockyard transport, was regarded as a proved fact; and, after many, trials a couple of "Boydill" engines found their way to Woolwich, amid a flourish of trumpets from those daily papers which considered themselves the friends of progress. Companies were established to introduce the engines of other makers. A glorious future seemed at last to dawn on the steam horse; and Mr. Punch's millenium, when every gentleman would possess his own private steam carriage, seemed to have nearly come. None of these expectations, formed three or four years ago, seem, however, to be fulfilled; instead of advancing in public estimation, the warmest advocates of the road locomotive must admit that its more extended adoption is as far off as ever, and that it sinks rather than rises, in that estimation which is the life-blood of every novel invention. Government offer their engines to the highest bidder. In other directions, we find steam locomotives offered for sale with the highly suggestive recommendation that they can easily be converted into stationary engines—a fact apparently deemed necessary to secure a purchaser.

Convinced as we are that by steam locomotion on common roads, many important prospective benefits are held out both to England and her Colonies, we think the investigation of the causes which have led to the partial failure of the system are well worthy the careful attention of our engineers. On the closest examination we fail to discover any defect in the principle on which success depends, which is, of course, just the same as that which has proved so eminently successful on our railways. To cause the revolution of a pair of driving wheels, which, laying hold of the road as a fulcrum cause the locomotion of the whole machine, is no very abstruse problem; and even though it were, it has met with a successful solution so long since, that no matter what our forefathers might have found it, we, their sons and grandsons, have no reason to complain. But, not content with the accomplishment of this feat, our sapient inventors have invested the question with a thousand difficulties which never existed; and with that usual disregard for the commercial success of their inventions which the inexperienced usually display, they have converted a really simple machine, into one so complex in its character, that expense and want of durability follow as a matter of course. The resulting depreciation in public opinion is, unfortunately, not confined to one particular class of engine; for if that class has been brought prominently forward it is soon regarded as a type of the entire system, which, of course, shares in the injurious consequences.

We do not hesitate to assert that in the endeavour to make the road locomotive perform too much, will be found one of the primary causes of that want of commercial success which has hitherto retarded its more general employment. Stephenson and his compeers were satisfied if their engines did one thing well; and by concentrating all the energies of the machine on the one object in view, they enabled it to attain the most satisfactory results. But modern inventors are not satisfied with the locomotion of their machines on hard roads, as Stephenson was; but attempt, in addition, to make it perform many other offices as well—in fact, nothing is too much to require from a traction engine, which, in the hands of some engineers, far more resembles the contents of a factory out for a walk, than a machine which should be alike distinguished for beauty of form and simplicity of design. We thus find them professing to drive all sorts of machinery by means of straps, as well as to possess the power of traversing the surface of swamps and moors at a moderate pace, while high speeds can be attained on good roads! The highest expectations are naturally indulged in by those whom the sanguine inventor can influence in the slightest degree; disappointment follows; and as we have already said, not only an individual machine, but an entire principle, undergoes condemnatory remarks, and comes to be regarded as a delusion and a snare.

The public is always ready to expect great things from an invention which has been proved capable of being worked out to a satisfactory result; and they have in this spirit doubtless, formed extravagant ideas of the capabilties of the machines we speak of—a result due in no small degree to the highly coloured paragraphs met with every now and then in local newspapers. We have heard of a gentleman—one, too, who pretended to some knowledge of mechanical engineering—who wished a firm to contract with him for the building of an engine which should attain a speed of fifteen miles an hour, unloaded, on a level road; should be suited to the traversing of grass land, with heavy loads of farm produce; should pump, saw, or thrash, and provide accommodation for two or three ladies in front, after the fashion of the Earl of Caithness's little pleasure carriage: we believe such instances are by no means rare. A London coachmaker would scarcely feel pleased by an order for a family barouche which should be capable of transporting farm produce to market. Engineers enthusiastically undertake to perform these constructive feats; prudent coachmakers are satisfied by building and selling the simplest machines they can contrive, well knowing that these alone pay.

Not content with the legitimate employment of steam power on our generally excellent highways, we find traction engines fitted up with the most costly appliances to enable them to traverse fields and lanes, where they never should attempt to go. It is simply absurd to expect them to work successfully on soft bad roads. Endless railways, shoes, and all such devices only add to the complication of the machine without serving any good purpose whatever. Even if they prove themselves mechanically successful, which to do them justice, at extremely moderate speeds they usually do, we must still recollect that steam power in England, at least, never can compete commercially with horses, in situations which render the use of such expedients necessary. It is on hard, moderately level, turnpike roads that we must expect the success of steam transport, not over bogs and morasses. In our Colonies the case is different; there roads are few and bad, and the engine may have to traverse the face of the country. There is no mechanical difficulty in this, the commercial difficulty must, of course, be a mere question of the comparative expense and efficiency of animal labour.

Another extremely injurious element is to be found in the slow average speed to which engines suited to the transportation of heavy loads have hitherto been limited. A speed of two or three miles an hour is too little when long journeys have to be performed, though it may answer well enough for short trips. The time lost in getting water is considerable, and should be provided for by the power of attaining a fair speed on favourable portions of the road, as in descending moderate hills. Engineers frequently propose to confer this power by providing cylinder and boiler room enough to attain a speed of even nine or ten miles an hour. We have little fault to find on that head; but we must recollect that, no matter what the facilities for the production of steam may be, a high speed may be quite beyond the powers of the machine, as far as its abilities to resist the injurious effects of rough roads are concerned. Shoes and endless railways, too, can never be persuaded to work quietly or satisfactorily at fair speed; and this is yet another reason why they are likely to prove injurious rather than beneficial to the entire system.

Smooth wheels, with sufficiently large bearing surface, provided by considerable breadth of tyre, moderately loaded; simple mechanism, unburdened with cranes, winding drums, &c., &c., and, above all, good and flexible springs, are absolutely essential to the high speeds which should be attained on suitable portions of the road, in order that ample margin may be left for delay in ascending steep hills, taking in water, and the other delays incidental to a moderate journey.

Let traction engines surpass horses in the speed with which they transport goods or merchandize, as well as in the actual power of moving enormous weights, and we find the chances of their commercial success trebled; but let each of those duties be performed by separate machines, if any complication is to be induced by the attempt to perform both with one engine. It may, indeed, be urged that suitable gearing enables speed and tractive power to be used interchangeably; but the extra tractive power is seldom available from want of adhesion, unless we resort to weights far too great to be recommended for comparatively high speeds. Express engines are not employed to draw goods trains on our railways.

That machine is most perfect which is most simple; and from simple arrangements of steam machinery can we alone expect the perfection of a system which possesses advantages sufficient, under proper management, to lead to ultimate success; but it must be borne in mind that in the road locomotive we have a nice arrangement of machinery, unavoidably compelled to perform its work under the most trying circumstances to which machinery can be exposed. Their successful construction, therefore, renders necessary a special knowledge of all their requirements, which nothing but practical experience can give. Hardly any other machine demands so much attention to minute matters of detail, which the theorist is certain to overlook; and of one fact we may rest certain, that all attempts at complicated "improvements" in railroad locomotives have failed and will fail, that their present success is mainly due to their beautiful simplicity, and that our road locomotives must conform to somewhat similar rules and principles, before we can expect that peculiar mechanical perfection, on which commercial success waits as a handmaid.

CHAIN CABLES AND ANCHORS.

It is not improbable that the Bill lately introduced in Parliament by Mr. Laird, for enforcing a test of the chain cables and anchors used in the merchant service, will be included in the "Massacre of the Innocents," that generally takes place at the end of a session. Bills for the same purpose have been previously brought before Parliament, but without being carried. This time, however, the misfortune is not so great; and, indeed, it may almost be doubted whether a compulsory Act is required at all; for since the latter end of November last, Lloyd's have taken the matter into their own hands, and they undertake to prove, for a small sum, any chain cables and anchors brought to them for that purpose. Every ship, however, is not classed at Lloyd's; and reliable chains and anchors are necessarily of such importance to the safety of those "that go down in ships on the deep," that it would perhaps be best if every large seaport were provided with a public testing machine.

An excellent description of the proving-house of Lloyd's Committee, erected last year by T. M. Gladstone, C.E., in the New-road, Poplar, near the West India Docks, will be found in our number for May 15. The description was extracted from a contemporary. Having lately inspected the works in question, we are enabled, by our own observation, to completely endorse the laudatory observations of our contemporary on the mechanical arrangements of this establishment, designed and erected under the superintendence of Mr. T. M. Gladstone. More than 1,000 tons of chains and anchors have been already tested at the Poplar Proving-house since the beginning of December last, and there is a daily progressive increase in the number of cables tested. No less than 117 tons of cables, and 12¾ tons of anchors, were tried last week. As may well be imagined, Mr. Gladstone can show quite a "Museum of Morbid Anatomy" of broken links—a collection containing specimens of the most varied structure and quality of iron. In the great majority of cases a link gives way in the welding; this happens, according to Mr. Gladstone, in nine cases out of ten. The welding is generally made at the side of the link; but when the link breaks in sound iron, one of the ends is almost always sheared out and torn away. As a rule, all chains above 1 in. are welded on the side; the exceptions that occur are through motives of mistaken economy. We noticed a 1⅞ in. link (evidently made of imperfectly-puddled iron), which broke at only 45 tons; the Admiralty proof for this diameter of link is 63¼ tons. The breaking strain of good cables, made of No. 3 iron, is about 25 to 28 tons per square inch; this strength appears to get reduced by about one-fifth by being put into the form of the cable; the specimen we noticed, however, thus broke at little more than 8 tons to the square inch. Each cable is of course measured before being brought under the strain of the press, and its permanent elongation is noticed and marked on the certificate. On an average, cables appear to stretch permanently 6 ft. in 90 ft. Mr. Gladstone has a pressure indicator in his private office on the first floor, by which means he has a constant check on what is going on down below. This indicator consists of a common Schæffer's gauge, under the pressure of water. It might be objected that it would be difficult to identify a chain that had been tested, and that the certificate given with each tested chain might be used for another which had not undergone the test; or again, that an unprincipled manufacturer might obtain an unlimited number of certificates from the same chain, with the intention of applying these false certificates to untested cables. The system adopted at the Proving-house completely meets these objections. Each cable is stamped with the date of the test, and in addition there is an ingenious system of private marks, by which the ship surveyors can always identify the chain with its certificate. The position of the marked link is determined by a secret formula which takes the length of chain into account, and any alteration, through accident or design, in the length of the chain, must be marked on its certificate.

The adoption of this organized system on the part of Lloyd's Committee has, no doubt, in a great measure resulted from the evidence adduced before the Select Committee appointed by the House of Commons, in 1860, to inquire into the manufacture of anchors and chain cables for the merchant service. As stated by the Committee, the evidence of the witnesses showed at the outset that losses of chain cables and of anchors by breaking happened very rarely in Her Majesty's Navy as compared with the merchant service, in which disasters are continually occurring from deficiencies in this part of a ship's tackle. A well-known instance of this difference between the two services, that will recur to the minds of most of our readers, was shown in the great hurricane that caused such a devastation amongst our transports in the Black Sea in 1854. The majority of the merchant ships parted with their cables, and were drifting about and being dashed to pieces against the Crimean coast, while there was not one ship in the Royal Navy but rode out the storm in safety. Sir Deans Dundas, then commanding the fleet, addressed a public despatch to the Admiralty, in which he reported the perfect efficiency of the chain cables supplied to Her Majesty's ships.

The system of testing was first established by the Admiralty in 1833; but previously to that date a certificate was sent by the contractor with his cables, proving that they had been tried on his premises. The chief clerk of the Store-office, Mr. J. R. Clark, in the course of his evidence before the Select Committee in 1860, also stated that chain cables were first introduced into the Royal Navy in 1810 by the then Lieutenant Samuel Brown, who patented his invention in 1808. It may be stated that an iron chain weighs, on an average, 2½ times as much as a hempen rope of the same strength, while the diameter of links is about 3-10ths of that of a similar rope. A hempen rope is thus easier to lay out than a chain cable, but the smaller space taken up by cables has allowed a reduction of the tiers of a line-of-battle ship.

There can be little doubt as to the utility and, indeed, absolute necessity of a test for such wrought-iron work as cables and anchors. It is impossible for the most practised eye to ascertain whether a weld be good or bad; a little extra hammering will soon cover up and hide any deficiency in that respect. In the same way, the quality of the iron may have been originally good, but the material may have been burnt by unskilful forging. A famous physician is said to have once expressed a wish to possess the ability of walking down his patents' throats with a lantern in his hand, and to thus form a correct diagnosis of their state of health. It is just as impossible for us to get into the inside and at the ultimate structure of iron, and so we must content ourselves with extraneous trials. We would thus advocate a universal system of compulsory tests for all ships' cables and anchors, to be conducted under the supervision of the Board of Trade. It was in evidence before the Committee formed in 1860 to examine into the question, that, during a period of five years, of the cables sent to the Liverpool testing machine, 82½ per cent. were imperfect cables. Now, if the test be not compulsory and be not universally applied, it is not improbable that rejected and imperfect cables will find a market amongst the ignorant or the unprincipled.

It has been stated at different times that chain cables are injured by the tests applied. In order to prove that no injury is brought on cables by testing, Mr. William Willcocks, the Master Smith at Woolwich, gave the following interesting account of an experiment made by Government to ascertain the truth of the case. A length of 2¼ in. cable, the proof of which is 91⅛ tons, was tested in the usual way. The chain was made by Hawks and Co., in 1843. "It was subsequently tested to the proof strain twice, and then broke at 119·5 tons; after which, being shackled together, it was tested to proof strain twice; then to 119·5 tons; then to 120·5 tons; then to 223·3 tons; then to 126·625 tons; then broke at 123·125 tons. It was then shackled together, and proved up to 127·5 tons; then to 134·25 tons; men exhausted; then broke or crushed a stay-pin, and broke the link thus unprotected at 133 tons. I beg also to state, that a length of 2⅛ in., the proof strain for which is 81¼ tons, was afterwards broken at 100·75 tons; then to 109·25 tons; broke at 109.75; again shackled together, and broke at 108 tons; then at 110 tons. The second piece ultimately bore at the 13th trial 122.625 tons." In answer to a question by Admiral Duncombe, Mr. Willcocks stated that he had never known an instance of a chain cable, often being tested, breaking at a much lower strain than that it had undergone during the test. The experiments we have referred to were continued, and a length of 1¾ in. was tried, the proof strain for which is 55⅛ tons. At the sixth trial, this broke at 83·625 tons. The second piece of the same size was also tested, and it broke at the eighth experiment, also at 83·625 tons. "A length of 1 in. cable was also tested, the proof for which is 18 tons; ultimately it reached a breaking strain at the ninth trial at 26·375 tons. The second piece of the same size broke first at 15·5 tons, at a very weak part of the swivel, being a quarter of an inch under the required size; the pieces were, as before, shackled together up to seven times, when it broke at 26·75 tons."

These trials were evidently made on iron of a very high quality. It will be apparent, on reflection, that a cable might be made so as just to stand the proof, and yet be of a bad material. In such a case the Admiralty test of 630 lb. per circular ⅛ in., or 11·46 tons to the square metre, might materially injure the structure of the iron. The plan to partially meet this difficulty would be to occasionally break a link in the chain, so as to examine the quality of the iron, and this was, in fact, proposed by several witnesses before the Committee of 1860; amongst others by Mr. T. M. Gladstone. It is worthy of note that Mr. William Pope, the Surveyor for Lloyd's at Liverpool, during the last twenty years, objected to the Admiralty test as being too high, and apt to cripple inferior qualities of chain. He proposes that cables should be subjected to only half the usual Admiralty test, in order to try the welds, while a few links of every cable, indiscriminately chosen, should be broken by the testing machine in order to ascertain the quality of the iron used in the cable. Iron, unfortunately, varies so much in quality, that applying the same test to all kinds alike certainly seems attended with some danger. This system would, however, evidently cause great expense to the manufacturer.

Another important question in relation to this subject, regards the re-testing of cables and anchors after being some time in service. Mr. W. Macdonald, the Manager of the Liverpool Corporation Testing Machine, and Mr. G. T. Thomson, a pilot of twenty years' standing, in the employ of Mr. Wigram, the eminent ship-builder and owner, both recommended this operation. Mr. Thomson would make it imperative to test every cable after being in use for six years. In addition to the usual deterioration of a cable through wear, rust, exposure, and accident, its material undoubtedly undergoes a change, losing its fibrous texture and assuming one of a crystalline character. The laws governing these molecular phenomena are as yet obscure, and have not been fully investigated, but the results are undoubted and have been noticed by most practical men. A familiar instance of this change is found in crane chains; and railway carriage axles undoubtedly get crystallized in course of time. Mr. Gladstone, in the course of his evidence before the Committee, alluded to the subject very fully; he proposed to obviate this deteriorating influence on the strength of cables and anchors by annealing them before being re-tested.

STEAM DOMES FOR LOCOMOTIVES.

Our engineers still seem to regard the steam dome as an indispensable adjunct to the locomotive; at least, few or none are built without them. Indeed there seems to be rather a tendency to increase their size and over estimate their importance, due in some measure, perhaps, to the increased adoption of the flush boiler, which is not considered to be so well suited to the supply of dry steam, as those which have the outside fire-box shell considerably raised above the cylindrical portion of the boiler. The advantages held out by the dome are, however, more than doubtful, and can scarcely compensate for the additional weight and expense incurred by its use, although it is urged that without it considerable difficulty is always experienced from priming. This, at best, but proves that such contrivances may be employed as a means of repairing faults of design in other departments of the engine, and by no means demonstrates as a fact that they are actually indispensable, or indeed, deserving of general adoption. In many engines we find them either omitted altogether without at all impairing the efficiency of the machine, or of such small size that they bear no comparison with the huge edifices recently introduced. Bury scarcely ever used the steam dome in its present form. True, he placed an immense hemispherical affair over his fire-box; but this, in all cases, formed part of the external shell, and was merely a means of supplying steam room. Forester's small domes were placed on an outside fire-box shell, the top of which was already raised 12 or 14 in. above the barrel. Such domes did not contain a cylinder full of steam, and were only intended to permit the elevation of the steam-pipe to a good distance above the water level—a plan since carried out by other makers with good results. Stephenson, it is true, did of old, as his successors do now, pretend to the extension of steam room by the use of large domes, though the advantages gained from them in that way can be realized by far better arrangements.

All things considered, if proper care be taken to secure perfect circulation in the water, we consider them unnecessary and injurious. It is not very easy to make a good dome; its welding is a job which requires both skill and care; and the difficulty experienced to some extent in making up the joint between it and the boiler shell, together with the cost of the outside ornamental casing, constitute it a very considerable item of expense. Its connection too with the boiler, must in some degree weaken the latter by rendering an aperture of considerable size necessary. Although a manhole is always requisite to permit the proper inspection of the interior of the boiler, it does not follow, as a matter of course, that this is best closed by a steam dome. The contrary is the fact; for the dome should be placed forward where the ebullition is least; while the proper situation for the manhole is, undoubtedly, over the fire-box—indeed we find one there as often as not; while a steam dome is fixed near the chimney, and supplied with an amount of internal apparatus, sufficient to prevent its use as an entrance to the barrel.

A very slight increase in the diameter of a boiler, will easily provide as much additional steam room as a very large dome can supply, and provides it, too, without extra expense or trouble, or weakening the boiler to any appreciable extent, not so much indeed as a large hole in the shell can do. Still some engineers seem to consider it necessary that the steam should be drawn from a point considerably above the water level; a conclusion scarcely borne out in practice, as we find very many engines, both here and in America, getting on very well without domes, and supplying steam to the cylinders dry enough to cause no complaint.

Aware of the objections attending the cutting of a large aperture in the boiler shell, many makers content themselves with drilling a great number of small holes in it, just under the dome. We have always found this remedy worse than the disease; for not only is a separate manhole still necessary, but in addition the perforated plate defeats the object in view, by inducing priming to a very considerable extent. This is one of those phenomena which no amount of theoretical consideration could teach us to guard against, although practical experience demonstrates the fact plainly enough: water once gaining access to the interior of the dome, as it is sure to do, is unable to return to the boiler, because of the rush of steam through the holes, and consequently finds its way, often in considerable quantities, to the cylinders.

All things considered, the best plan seems to consist in placing a small dome, when such a thing is considered indispensable, over the fire-box communicating with the interior of the boiler, by means of an aperture large enough to admit a man. The steam pipe should rise nearly to the top of the dome, and terminate in a large flared or trumpet-shaped mouthpiece, nearly as large as the diameter of the dome will admit, and finished off to an edge all round; over this should be fixed a hollowed plate, with the convex side up, of the same diameter, so that its edge and that of the trumpet-mouth may coincide, and not be more than an eighth of an inch or so asunder. This arrangement will be found to prevent, to a great degree, the entrance of water into the pipe, and is extremely simple, and easily fitted.

A flush boiler, however, undisfigured by a dome, is, in our opinion, absolutely necessary to that beauty and simplicity of appearance which is such a characteristic of the best class of locomotive. Dry steam may easily be obtained by the use of one or more perforated pipes traversing the upper part of the boiler. By diffusing the draft of steam, and not permitting it to concentrate at any particular place, priming may usually be best avoided, especially if ample water-space is provided round the fire-box as well. If this last is constructed with sloping sides, it adds, not only to the durability of the plates of which it is composed, but enables the boiler to supply dry steam even with the heaviest loads. Priming is far more due to defective circulation than to anything else; and with proper attention to the means of providing for this in the best manner, and by the use of perforated pipes, we see no reason why the unsightly and expensive dome may not be banished from our engines.

THE BESSEMER PROCESS IN FRANCE.[*]

The manufacture of steel under M. Bessemer's patents is still regarded by our Gallic neighbours with astonishment, which our ironmasters have long ceased to feel. The French steel-makers regard the whole process as little short of miraculous, and still look on its more extended introduction with a doubt and hesitation which is perhaps a principal cause of the slow progress made by the process towards more general adoption in France; indeed, it appears that there is but one factory in the empire, that of Jackson and Co., at St. Seurin, where the manufacture of Bessemer-steel is carried on, on anything like a large scale.

These steel works are advantageously situated on the river d'Isle, by means of which boats can deliver coal and iron on the wharfs belonging to the factory. A fall of water equivalent to 200-horse power gives motion to two large and three small water-wheels, which supply the necessary power for driving the various machines.

The founder of these works, Mr. William Jackson, grandson of the Jackson who introduced the Huntsmann process for making cast steel into France, finding a mill-site in so favourable a situation, for sale, purchased it, resolving to establish his hereditary manufacture. Soon joined in his enterprise by his father, he established some cementing furnaces, coke ovens, &c., and commenced the manufacture of cast steel on a small scale. Afterwards, availing himself of the power bestowed by the waterfall, he erected tilting hammers, rolling trains, and all the other machinery necessary to supply steel in large quantities. In 1856, hearing of the success of Bessemer's process in England, he erected, under licence, an apparatus capable of converting 700 kilogrammes of cast iron into steel at a time. Having experimented on an extensive scale for five years with almost unvarying success, he constructed the present apparatus, which easily converts 3,000 kilogrammes of cast iron at one operation.

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[*] Les Grandes Usines, Acieries Jackson and Co. Usine de Saint Seurin, Appareil Bessemer.

In the lower story of a large building are placed, facing each other, two large converting vessels, or as the French style them, *cornues*, formed of thick iron plates riveted together and lined with fire clay. These vessels turn on trunnions, so as to easily assume the different positions required during the work of conversion. Between them there is a circular area surrounded by a little trench, in which, half-buried, are placed the moulds to be filled. From the centre of this circular space rises a hollow pillar, some three or four feet high, carrying a forked lever at right angles, which can be raised or lowered at will by water pressure acting on a piston within the pillar. Within the fork of this lever is grasped a ladle, lined inside with fire clay, easily moved by an iron handle passing through the horizontal part of the forked lever; this ladle is pierced with a hole in the lower part, easily stopped or unstopped at will by a plug of fire clay, formed on the extremity of an iron bar, which can be raised or lowered as desired.

When the converting vessels are vertical, they present their greatest convexity towards each other, while the aperture at the upper end is directed into the side of a chimney or flue. Into the lower part of each, opens seven tuyères, each pierced with five holes. These tuyères communicate with the blowing cylinders by a tube, passing through the trunnions. The blast is produced by a steam-engine, the boiler of which is heated by the waste heat from the furnaces where the iron which is to be converted is melted. The selection of this iron is the most important consideration for the steel manufacturer. At St. Seurin good English pig is most generally employed—a suggestive fact for our own steel-makers. Mr. Jackson, in the course of his experiments, has tried Swedish, Perigord, Bretagne, and Commentry pigs. Of all the French irons, the last has given the best results.

The iron is melted in reverberatory furnaces, and poured into the converting vessels, previously heated by coke fires lit within them. When half-full, the blast is put on, and the converting vessel raised to a vertical position from the partially horizontal one it assumed while receiving its charge of molten iron. The force of the blast prevents the iron entering the tuyères. The combustion of the carbon in the iron is so intense that it bears no comparison with anything else. The flame escaping into the chimney is at first red, and attended with an immense number of sparks. After about twenty-five minutes it diminishes in intensity, when the person directing the operation causes the mouthpiece of the converting vessel to be lowered once more. A ladleful of a peculiar mixture of different irons is then poured into the converting vessel. In this mixture the whole secret of success seems to reside. This it is which converts into good steel the molten metal, which without it would be worthless. The apparatus being immediately raised once more, the blowing is recommenced, and continued for a very few minutes, when the operation is terminated—cast-iron has become steel.

The contents of the converting vessel is then poured into the ladle, which, guided and supported by the forked lever, can be emptied into the moulds which surround the central pillar on which the supporting lever turns horizontally. When each mould is full, the aperture in the bottom of the ladle is closed, and the workmen pass on to the next, repeating the process till the ladle is empty. By this means Mr. Jackson easily produces ingots of 200 kilogrammes, and large castings of 1,200 kilogrammes. By using both converting vessels at once, he easily produces castings of 2,500 kilogrammes to 3,000 kilogrammes. The yield of these works is, on an average, 5,000 kilogrammes per day—1,000 kilogrammes being rather less than an English ton.

"THE ENGINEER'S POCKET-REMEMBRANCER."*

Amongst the many "Engineer's Pocket-books" now bidding for the favour of the members of our profession, this particular specimen seems well-deserving of patronage. The above title shows the intended scope of the compilation, and the book appears to redeem the promise as completely as is possible in a work of this character. We say "compilation," although several of the formulæ are evidently original. The formulæ are also in all cases expressed by verbal rules, for those who are unaccustomed to algebraical notation. The low price of the book (5s. 6d.) places it within the reach of most men.

The ramifications of engineering practice are already so extensive, and the separate specialities are getting so fully developed, that it is doubtful whether any "Pocket-book" could be compiled to completely suit the wants of every branch of the profession. Take, for instance, agricultural engineering, which we might already call a separate branch. Except the general formulæ applicable to all engineering practice, no other aid is afforded by any Vade-mecum as yet published, to any individual whose practice lies in this direction. The ultimate result will probably be, that a special work will be required for each class of engineers.

MAGNESIUM.†

The following is an abstract of a very interesting article by M. Sonstadt, which has appeared in *Weldon's Register*. M. Sonstadt has devoted considerable attention to that department of chemistry which deals with the preparation of the comparatively new metals, and has recently patented a new process for the manufacture of magnesium on an extended scale:—

In the history of the world's "metallurgic" period, to the present time, there has been a nice gradation as to the class of metals wrought,—those metals which occur native, or in an easily reducible state, such as gold, silver, copper, tin, iron, and mercury, having been known since very remote periods; while the somewhat more difficultly obtainable metals, as arsenic, antimony, and zinc, were not worked, so far as each metal is distinctly and separately concerned, until comparatively modern times. Not till the nineteenth century were any metals obtained on a commercial scale which were not obtainable by such simple processes as washing, roasting, and reducing the ore by the aid of heat in contact with charcoal or other carbonized matter, with the addition only, in some cases, of limestone, or of fluor-spar, for fluxing.

As the magnificent new dyes obtained from coal-tar products primarily owe their discovery to the purely scientific investigation of the coal-oils by Faraday some thirty years before, so chemical metallurgy may be said to date from the time when Sir Humphry Davy proved the existence of metallic bases in certain alkalies and alkaline earths. Davy isolated those metallic bases only in very small quantities, and by means only of the most powerful galvanic battery then in existence. Brunner afterwards obtained potassium by the ounce, by heating hydrate or carbonate of potassium in contact with very finely divided and intimately mixed charcoal, in a gun-barrel, or in a mercury bottle, with tube and condenser attached. Until Deville conceived the happy thought of introducing aluminium to the arts and manufactures, potassium, costly as it was, was far less costly than sodium: a given weight of the latter, nevertheless, being able to do more chemical work than the same weight of potassium, inversely to the proportion of 23 to 39, since such are the combining proportions respectively of the two metals. Influenced mainly by this consideration, Deville addressed himself earnestly to the task of cheapening sodium, the cost of sodium being the index to the cost of aluminium, since the latter is obtainable from some of its comparatively inexpensive compounds by the inexpensive process of the reaction upon them of sodium at a red-heat. Deville soon found that sodium could be obtained much more readily than potassium. When dried carbonate of sodium (from the crystals) is intimately mixed with charcoal, or coal-dust, and a little carbonate of calcium, the mixture placed in an iron bottle (such as mercury is imported in), with tube and receiver adapted, and the bottle heated in a furnace to near whiteness, sodium distils over abundantly, and drops from an aperture in the receiver into a vessel, containing naphtha or bituminous oil, placed to receive it. In this process, the sodium is eliminated in an atmosphere of carbonic oxide, from which,—singularly enough, as no such reaction takes place with carbonic acid,—sodium reduces carbon with liberation of oxygen, and, of course, the loss of metal by the formation of oxide of sodium. Hence the use of the carbonate of calcium, which at a high heat liberates carbonic acid gas, and this serves as a carrier to the sodium vapour, conveying it rapidly to the receivers, where it is condensed before any notable quantity can be lost by the reaction with the atmosphere of carbonic oxide in which the sodium is generated. Sodium may be obtained on almost any scale by what is essentially the same process, long malleable-iron cylinders being substituted for the iron bottle.

Aluminium is obtained by the action of sodium at a red-heat upon the double chlorides, or fluorides, of aluminium and sodium. Sometimes the chloride of aluminium is vaporized, and the vapour brought into contact with sodium vapour, when aluminium is liberated. In any case, the sodium simply replaces the aluminium by reason of its stronger affinity for the halogen with which the aluminium was combined. Precisely similar is the reaction of sodium with certain salts of magnesium and of silicium, both of which are displaced by sodium from their combination with chlorine, and also, in the case of the latter, from fluorine. Sodium is not, however, able to reduce all the metals of the earths from their chlorides, as was once erroneously supposed. Matthiessen has shown that what was supposed to be calcium—obtained by the reaction of sodium or of potassium upon chloride of calcium—was only a combination of potassium with silicium and aluminium, a result which experiments completely confirm. Still this remains: that, possessed of sodium, we are able to obtain, in quantity, two metals and a metalloid; that is to say, aluminium, magnesium, and sodium, which exist in various combinations in such abundance as to make up, with oxygen, the greater portion by far of the earth's crust. The first of these, aluminium, is the only one which has as yet been transferred from the laboratory of the chemist to the workshop of the artisan. Aluminium leads the van of those metals which, although the most plentiful of all in nature, are not procurable by processes simply metallurgical, in the antiquated sense of that word. Dr. Percy, however, defines metallurgy as "the art of extracting metals from their ores, and adapting them to various processes of manufacture." This definition does not exclude processes usually considered chemical. Yet it would seem convenient to regard that branch of metallurgy which has the extraction of aluminium from a prepared ore of aluminium for its type as "chemical metallurgy," a new art which calls Deville father.

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* "The Engineers' Pocket-Remembrancer. An Epitome of Data, Rules, and Formulæ, applicable to Civil, Mechanical, Marine, Hydraulic, Lighthouse, Telegraphic, Railway, and Gas Engineering, Surveying, &c." By Francis Campin, C.E. London: Atchley and Co., 106, Great Russel-street. 1863.

† Specification of Edward Sonstadt. "Improvements in the Manufacture of the Metal Magnesium." Patent dated November 8, 1862. London: Great Seal Patent Office, 1863. "Du Magnésium:" par MM. H. Sainte-Claire Deville et H. Caron. *Annales de Chimie et de Physique.* Mars, 1863.

Excluding some three or four rare and little-used metals—as palladium, rhodium, iridium—there were, prior to the introduction of sodium and of aluminium, but twelve metals used for industrial purposes in either a pure metallic state or in alloy. These metals are gold, silver, iron, copper, tin, lead, mercury, zinc, antimony, nickel, bismuth, and platinum.* Of all these metals, the ores of iron alone can be considered abundant enough to be of geological importance. But far more abundant than iron itself are silicium, aluminium, calcium, and probably magnesium. Yet none of these, aluminium only excepted, are known to commerce. In the extraction and application of these metals, then, how magnificent is the field open before our generation!

Magnesium, although a less plentiful constituent of the earth's crust than calcium, enters into the constitution of a great variety of minerals. It is found occasionally combined with phosphoric and with boracic acids. But it is in combination with silicic acid that it is most universally diffused. Precious serpentine, and meerschaum, are hydrated silicates of magnesium. Venetian talc, white augite, amianthus, and the varieties of amphibole, are also examples of silicates of magnesium associated with more or less of foreign substances. Carbonate of magnesium constitutes a range of low hills in India. The rarer hydrate occurs in a few localities. But the most economically important mineral containing magnesium is Dolomite, which consists of carbonates of magnesium and of calcium, and usually overlies (with or without the intervention of sandstone conglomerate) the coal formation. In England the magnesian limestone formation extends, with little interval, from Tynemouth to Nottingham, a distance of 147 miles. At Sunderland the bed is fully 600 feet thick. It is this magnesian limestone which furnishes most, if not all, of the magnesia prepared in this country. Abroad, magnesia is economically obtained from the mother-liquors left after sea-water has been evaporated down for its salt. Probably these mother-liquors will ultimately turn out the best source of magnesium, since here the metal is associated with chlorine, and it is from the chloride that the metal is most readily procurable. Every ton of sea-water contains a fraction over two pounds avoirdupois of magnesium in combination with chlorine, and almost exactly half that quantity combined with sulphuric acid. A rough calculation shows that, if the surface of the ocean be taken at twice that of the land, and its average depth at three miles, then, the specific gravity of magnesium being 1·75, the ocean contains about 160,000 cubic miles of magnesium.

Davy, by means of his galvanic battery, proved the existence of magnesium, the basis of magnesia, of Epsom salts, &c., in 1808. Not till twenty years afterwards was it obtained by Bussy in sufficient quantity to allow of experiments upon its properties. The latest published process for obtaining magnesium is that given by Deville in the number of the *Annales de Chimie* for last March. The method is essentially the same as that devised by Bussy, but the details and the way of manipulating are described with admirable precision, and certain difficulties and disadvantages inherent to the process are pointed out for the first time in print.

To obtain magnesium by the method given in detail by Deville, the first necessary is anhydrous chloride of magnesium—that is, chloride of magnesium completely deprived of water. Now, when the hydrated chloride of magnesium is strongly heated, a portion of the water present is decomposed: the oxygen of the water displaces chlorine, forming magnesia, while the liberated chlorine seizes upon the hydrogen of the water, and escapes as hydrochloric acid gas. It is erroneously stated in some chemical text-books that this decomposition is complete, so that when hydrated chloride of magnesium is heated to redness nothing but magnesia remains, and a now happily unused method of estimating magnesium is based upon this supposed complete decomposition. M. Sonstadt has heated hydrated chloride of magnesium to redness, wetted it thoroughly with water, and again ignited it, seven times successively, and yet a considerable quantity of chlorine remained unexpelled. Nevertheless, it remains true that, when hydrated chloride of magnesium is heated to redness, even when as much as possible out of contact of air, the mass of mixed chloride and magnesia is infusible, and in a condition totally unfit for the extrication from it of magnesium. Three methods are known of obtaining anhydrous chloride of magnesium, only one of which will be mentioned here—that preferred, and justly preferred, by Deville. It consists simply in evaporating to dryness, and then heating to redness, in a covered crucible, solutions of the chlorides of magnesium and of ammonium, mixed in the proportion of their equivalents. Simple as this appears, it is not a very easy or a very certain process to conduct in porcelain crucibles; and whether the crucibles are of porcelain or of platinum, there is inevitably enormous waste, owing to the volatilization of a considerable portion of the chloride of magnesium in a state of chemical combination with the volatile chloride of ammonium. The amount of the loss thus sustained, according to his experience, averages six-sevenths of the entire quantity of chloride of magnesium with which the experiment may be begun. But even the chloride of magnesium that remains is not free from magnesia, which settles to the bottom of the fused mass; and it is hardly possible to completely expel all traces of the ammoniacal salt, by howsoever prolonged ignition. But ammonium contains nitrogen, which, in the after process for getting the metal, combines with the magnesium, giving it a yellow tint, and rendering it extremely oxidable.

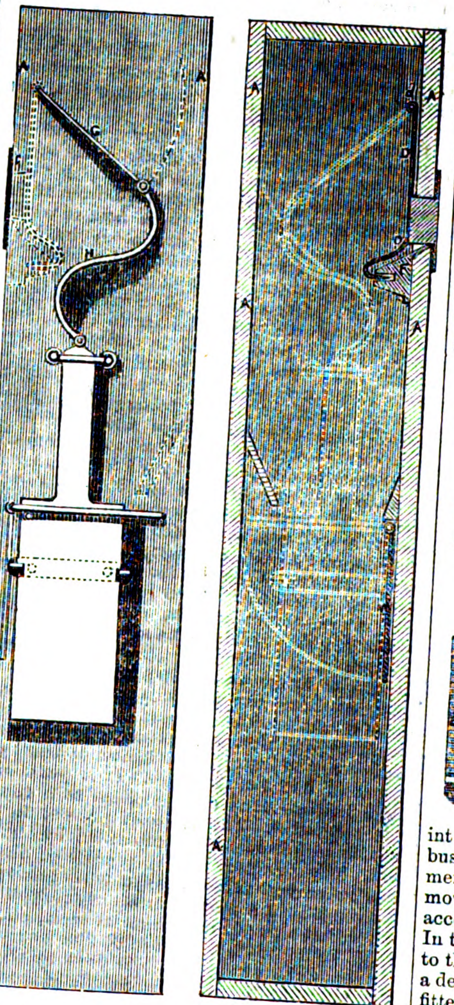
Recurring to Deville's process. Anhydrous chloride of magnesium being obtained—although not free from nitrogen—it is mixed with powdered fluor-spar, previously purified from silica and from phosphoric acid (with both of which fluor-spar is invariably associated) by long digestion in cold sulphuric acid, and subsequent washing with water and drying. To the mixture of 600 parts chloride of magnesium with 480 parts of the purified fluoride of calcium (such are the proportions) is added, in large pieces, 230 parts sodium; and the whole is thrown into a red-hot clay crucible, which is quickly covered. The heat being raised, the reaction is soon over. When the crucible is somewhat cooled the cover is removed, and the pasty mass is compressed by a broad iron rod, so as to push together into one lump the small globules of magnesium interspersed throughout. The magnesium thus formed contains carbon, silicium, and nitride of magnesium. From the two former impurities Deville separates magnesium by distillation of the impure metal in a tube of gas-retort carbon, enclosed air-tight within a glazed earthen tube. A strong heat is required, and throughout the whole process a current of hydrogen gas is passed through the tube containing the magnesium. A drawing is given of the distilling apparatus, from which it would appear that the carbon tube is about 6 decimetres in length, and has an internal diameter of 4 or 5 centimetres. It is possible to distil half-an-ounce of magnesium at a time in this apparatus. The nitrogen present in the impure magnesium is not separated by distillation. With respect to this process of distillation in carbon tubes it is only necessary to observe that the method is utterly inapplicable on any but a purely experimental scale, and few would be fortunate enough to be able to procure a carbon-tube even of the size used by Deville. The presence of silicium in the magnesium obtained in the clay crucible is due to the silica present in the clay. Magnesium has a remarkable affinity for silicium, and reduces it from all its compounds with great facility, so that it is impossible to obtain magnesium in a siliciureted crucible (an ordinary clay crucible is about half silica) without obtaining highly siliciureted magnesium. A platinum crucible cannot be safely used for the reaction, since a piece of magnesium heated in a platinum crucible will run a hole through it almost as quickly as a piece of lead will. Porcelain crucibles are objectionable on the same ground as clay crucibles, than which they are yet more silicious; besides which, they are very liable to break, and are restricted to a small size. The carbon described as existing in the crude magnesium is probably derived from naphtha adhering to the surface of the sodium used for reducing the magnesium. The only way to avoid the presence of carbon in magnesium is to use perfectly clean sodium. There is another impurity besides carbon, silicium, and nitrogen, contained in crude magnesium, to which the French chemist does not advert, but he states that the residuum left after distilling magnesium is of an unascertained, but exceedingly complex, nature, which evidences that he is aware of the presence of at least one unascertained impurity beyond the three specified. The nature of this fourth impurity will be treated of further on.

The new process for preparing magnesium, which it is supposed will be applicable on a manufacturing scale, is based upon the two following main facts: (1) That when a mixed solution of the chlorides of magnesium and of sodium is evaporated to dryness and then heated to redness, a fused mass remains, which, heated with sodium, gives magnesium; and (2) That magnesium does not sensibly act upon iron when air is excluded and the heat is not raised excessively high. Hence it follows that iron vessels may be used in which to effect the reaction of sodium upon the "material," or fused mass obtained as described. These are the two hinges upon which swings the gate, which, it is trusted, will open a new room in the house of Industry for the occupancy of man. The process being independent of the use of chloride of ammonium, saves the loss incurred when that salt is volatilized off chloride of magnesium; the enormous waste of the magnesium chloride which occurs in the old process is also prevented; nitrogen is not present in the "material" thus made; and the manipulation of the new process is so easy that it has been successfully conducted in my laboratory during my absence by an unskilled servant-lad. When clay crucibles are used for every operation; the size of the vessels can hardly be increased beyond certain narrow limits; and the magnesium obtained in clay vessels cannot be other than siliciureted. A good iron crucible, on the other hand, will last, with care, for more than a hundred operations, as my experience has proved; its size may be increased at will; and the magnesium (unlike aluminium, which may not be prepared in iron vessels), derives nothing from the iron. But there are two minor matters which require mention. The first of these is that the magnesia of commerce is unfit, owing to the presence of sulphates in it, for the production of magnesium; wherefore, if the mother-liquors of sea-water are not accessible, magnesia requires to be specially prepared, in view of the manufacture of magnesium from it. This special preparation simply consists in the thorough washing with pure water of freshly precipitated carbonate of magnesia, then drying by pressure, washing again, and so on, until the wash waters—properly acidulated—give no precipitate with chloride of barium. The other point relates to a new method of obtaining anhydrous chloride of magnesium, which consists in heating the hydrated chloride up to redness in a current of perfectly dry hydrochloric acid gas, which carries off the water associated with the chloride. The fused chloride of magnesium thus obtained may be used for the production of magnesium, or as a bath in which, when crude magnesium is fused, it becomes freed from sodium, with which it is usually alloyed in its crude condition. The magnesium obtained by the foregoing process is still impure, and therefore may be distilled with advantage. The description of M. Sonstadt's method of distilling magnesium (which is applicable on any scale); the details of the processes just cursorily described; and an account of the properties, chemical and mechanical, of magnesium, M. Sonstadt reserved for a second paper.

Reference was made above to a "fourth" impurity, always present in crude magnesium, but which, it was hinted, had not yet been described. This M. Sonstadt takes to be a new metal, not hitherto recognised. His researches into this matter began about eighteen months ago; but it was only a few weeks back that, after numberless failures, he hit upon a method of procuring a salt of the metal in what there is reason to believe is a state of purity. The quantity obtained was very small, little over a grain. Nevertheless, partly from previous experiments upon the impure element, partly from such as could be made on the little that was obtained in purity, the following partial description of its reactions and properties may be relied upon. [For convenience of naming, and provisionally, M. Sonstadt calls this metal X.] The most remarkable feature about the salts of X is their wonderfully close chemical resemblance to those of iron, and to this circumstance must be attributed the late discovery of the metal, which must have appeared as iron in many hundreds of analyses, for there can hardly be a laboratory in this country in which an oxide or salt of X, in a state approaching purity, has not been repeatedly obtained, and set down as iron. As with iron, the salts of X give a blood-red colour with sulphocyanide of potassium. As with iron, its acid peroxide and perchloride solutions give a blue precipitate with yellow prussiate of potash, and also, after treatment with a reducing agent, as hyposulphite of soda, with red prussiate. But, unlike true Prussian blues, the blues given by X are unchanged, if pure, by excess of ammonia, no matter how large that excess, or for how long digested with the precipitate. If the solution of X be slightly contaminated with iron, the blue precipitate changes to purple on addition of ammonia, and, if much iron be present, gradually passes to the usual iron-brownish-red. The time which is required to effect this change in the blue from impure solutions of X, is an excellent indication of the degree in which it is contaminated with iron. If Pattinson's calcined magnesia be dissolved in excess of pure hydrochloric acid, and the solution, concentrated by boiling, be tested with solution of yellow prussiate, the blue colour formed will slowly change to purple, and still more slowly to brown, on addition of excess of ammonia. It is almost unnecessary to remark that there should be enough chloride of ammonium present in the solution tested to hold up the magnesium on addition of the excess of ammonia. In this experiment, an impure solution of X, containing iron, is tested; yet the reaction described is very distinct from that of iron. To obtain a pure solution of X, about one part amorphous phosphorus should be intimately mixed with eight parts calcined magnesia of commerce, and the mixture ignited in a covered porcelain crucible, until phosphorous fumes cease to be evolved. The whitey-grey mass that remains is digested in hydrochloric acid, the solution is poured off, and more acid added to, and boiled upon, the residue. The solution is again poured off, and the residue is boiled for several hours in fresh portions of acid. The well-washed residue, which is nearly black, is then ignited with hydrate of sodium, the mixture is dissolved in water, and the deposit washed with repeated portions of water by decantation. The process of washing is tedious, as the matter (which is of a yellowish colour) is very slow in subsiding. The acid solution of the well-washed deposit gives the pure reactions of X. It is evident that this process excludes the possibility of the presence of iron with the oxide of X. The theory of the process is, clearly, that the phosphorus reduces the mixed oxides of iron and of X to the metallic state, or to the condition of a lower oxide; and that in this condition, X, or its low oxide, whichever the black powder may be, is unattackable by hydrochloric acid, whereas the iron is taken up, and so separated. The black powder, when thrown into the fused hydrate of sodium, causes effervescence. It seizes oxygen from the water of the soda, and liberates hydrogen. The oxide of X thus formed is that which corresponds with the sesquioxide of iron, as is proved by its acid solution giving the blue (unchangeable by excess of ammonia), not with red, but with yellow, prussiate of potash. Its precipitate with an alkali, when ignited before the blow-pipe on charcoal, requires much more intense heat for its reduction than ferric oxide requires, and the dark spongy mass at last obtained is not in the slightest degree attracted by the magnet. He has not yet found any reagent capable of directly separating iron from X, when both are together in solution, nor any solvents discriminative of their respective precipitates. The consideration of the important bearings which X has upon the theory and practice of the methods of obtaining magnesium, must, like the other deferred matters, be postponed to a second paper.

SIMPSON'S LETTER-BOX.

In order to prevent the withdrawal of letters from boxes or other receptacles in the doors of dwelling-houses and offices, the invention, which we illustrate in the accompanying engravings, has been patented by Mr. W. Simpson, of Liverpool.



A is the casing forming the letter-box, and enclosing a lever and other appliances; C, a fixed plate surrounding the receiving opening, which is similar to that of most ordinary letter-boxes; *d* is a joint formed on the interior front of the box, to which is attached D, a swinging cover, the front of which is formed with a block piece, which takes into and closes the opening through which the letters are introduced into the box, and the lower edge of which is bent, and forms a cutter in conjunction with F, a metal block fixed across the inside of the box immediately below the receiving opening, and which block is constructed with a longitudinal horizontal slot forming two cutting edges between which the horizontal lower edge of the flap works and acts as a pair of shears for cutting twine, wire, or other like material which may be used for attempting to extract the letters or other articles deposited in the box; G, is a lever arm attached to the axle of and actuated by the flap or swinging cover, to the outer end of which is jointed a curved connecting link rod jointed to the top of the shank of a weight working within guides; a stud pin on the vertical sliding plate acts against the under side, and elevates the cut-off plate M to a horizontal position. The lever divides the box into an upper and lower chamber, when the lower edge of the port covers is pressed sufficiently backwards by the hand or otherwise to be clear of the cutter block. N is a guard fixed across the back of the box. The hinged plates are furnished with a sharp serrated cutter edge. The operation is as follows:— On pushing back the swinging cover D by pressing on the block, the lower edge of the flap D will be withdrawn from between the jaws of the block, and the lever G connected to the axle thereof will be elevated, end carry with it the curved connecting rod H and the weight plate, the stud piece acting on the under side of the lever will be brought up to a vertical position before the lower edge of the flap D has left the jaws of the block F, and the swinging guard M will be brought into a horizontal position, dividing the box into an upper and lower chamber, when a letter or other article may be pushed through the opening E, when it will fall upon the top of the tilt-plate M, where it will remain until the pressure on the block is removed, and the lower edge of the flap D again enters the jaws of the block.

SHANKS' LAWN MOWING MACHINE.

Mr. Shanks, of Arbroath, has recently patented further improvements in machines for cutting grass. The improvements consist—1, In dispensing with the ordinary cutter bracket with the screw for raising it up and down, and in substitution thereof an eccentric bush, fitted into the frame of the machine. This eccentric bush is provided with a slotted flange, and by merely turning it round the cutter or actual mower is raised or lowered as may be desired, according to the direction of the turning. 2, In the placing or attaching a flap or pendent end to the grass box of the machine when fitted with a delivery apparatus. This arrangement is so fitted that when the travelling end is at one end of the box the flap at the other end is down, and this part opens when the travelling end begins to move.

FIG. 1.

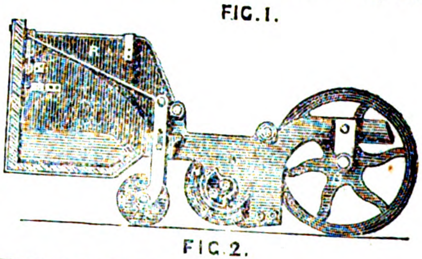
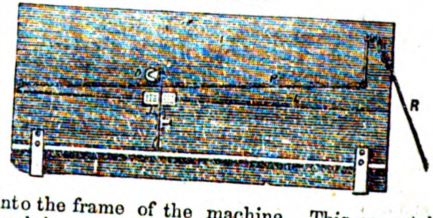


FIG. 2.



The framing A of the machine, shown at fig. 1, is of the usual construction; the after part is supported on the duplex rollers B, whilst the forward part of the frame is carried on the rollers C, which may be adjusted so as to regulate the height of the machine from the ground. At the central part the framing extends downwards, partially covering the open cylindrical frame to which the helical cutters are fixed. To the outside of the framing at this part is fitted a quadrant on each side of the machine. These have formed in them a segmental slot, as shown. Each quadrant or bush is retained in the desired position by means of a screw and pinching nut which hold it firmly in position. The bushes are carried on the cutter shaft. The object of this arrangement is to afford a ready and efficient means of adjusting the height of the cutter from the sole plate. This is done by loosening the nut and turning the bush round to the desired extent, so as to raise or lower the bearings of the spindle.

Another improvement in connection with these machines consists in an arrangement for instantaneously discharging the contents of the grass box without requiring the machine to be stopped or otherwise interfering with the progress of the work. The grass box or receiver I, into which the grass is thrown by the action of the rapidly revolving cutter H, is fitted with a moveable partition or travelling end piece J, which serves, when moved from end to end of the grass box, to deliver the cut grass in a body out at the side of the machine. This end piece J is fitted on the outer edge with a grooved pulley, which runs to and fro on the horizontal bar or rail L, fixed to the back of the grass box. The end piece is also fitted with a pulley at the lower part where it traverses over the shelving part of the box I, so as to cause it to move easily to and fro. A socket is bolted to the end piece, and to this socket is jointed the front end of a hand lever, which extends upwards and in a backward direction so as to be within convenient reach of the person guiding the machine. When the end piece is caused to move from left to right, or from one end of the box to the other, for the purpose of discharging the cut grass, it also operates a flap door which is arranged at the opposite end of the grass box. At the upper part of the end piece is fitted a pulley O, which traverses to and fro on the angular bar P. This bar or rod is centered at one end on a pin projecting out from the face of the box I, and at the other it is jointed to the bell crank lever. The horizontal arm of the lever is connected to the swinging flap door R, which is hung. When the operator desires to discharge the cut grass from the box I, a simple movement of the hand lever, from right to left, will cause the end piece to traverse in the opposite direction. As the end piece moves along, the pulley O depresses the rod P, which draws down the crank lever and raises the flap door R, so that the grass is free of any obstruction. The operator instantly releases the hand lever, when the weight of the flap R causes the pulley O to descend the bar P rapidly; and thus restores the end piece to its normal position. In this way the person guiding the machine can by an exceedingly simple movement discharge the grass from the box I from time to time as required.

CAPTAIN NORTON'S IMPROVED RIFLE SHELL.

Captain J. Norton, late of Her Majesty's 34th Regiment, has sent us a rifle shell, having a parchment sabot fitting tightly thereon, as clearly shown in the annexed sketch. The parchment is put on wet, in two or three layers, and then pressed through an iron tube; when the parchment is dry, it becomes as close-grained and hard as ivory. The sabot is divided into five divisions, like fingers, which relax their grip and fall to the rear on leaving the muzzle of the rifle. The shell within the sabot is rifled, and is adapted to the three-deep-grooved rifle. We believe the above shell is intended to compete against the Armstrong lead-jacketed shot or shell according to the challenge issued by Captain Norton.

SPRUYT'S IMPROVEMENTS IN RAILWAY RAILS.

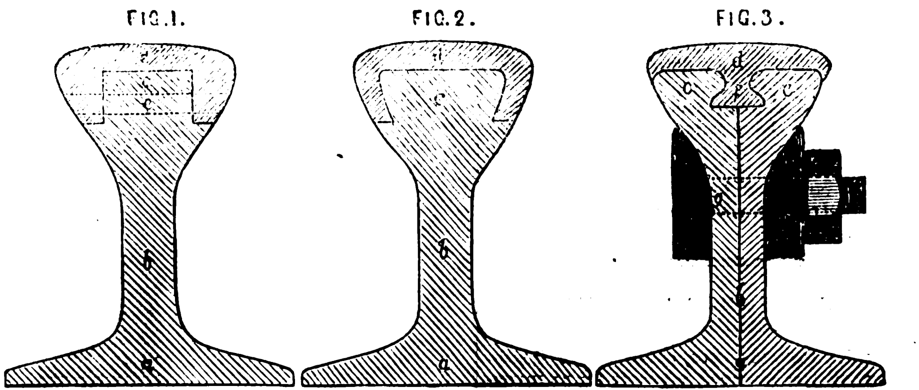


FIG. 1. FIG. 2. FIG. 3.

SPRUYT'S IMPROVEMENTS IN RAILWAY RAILS.

The accompanying engravings illustrate three sectional views of railway rails of an invention just patented by Mr. C. W. Spruyt, of New Broad-street. The invention consists in forming rails in two parts—the foot, the web, and a shoe in one piece; and the top in another piece. The top is shrunk, bolted, or otherwise attached to the shoe, and when worn it can be removed, and another top may be fixed on the same shoe.

The invention also consists in inserting between the shoe and the top a layer of lead, hardened rubber, or other material softer than iron.

Fig. 1 shows in transverse section one method of forming rails. The rail is formed of two parts—the foot *a*, web *b*, and a shoe *c* being in one piece; and the top *d* in another piece. The top *d* is placed upon the shoe *c*, and secured thereto by pins *e*, placed at suitable distances apart.

Fig. 2 shows a modification of the form of rail represented in fig. 1, in which the upper part of the shoe *c* is bulged out or enlarged, so that the top *d*, which is of corresponding shape, is held without the aid of pins. The top *d* may in this case be drawn longitudinally on to the shoe *c*, while hot, so that the shrinking consequent upon the cooling may cause it to grasp the shoe more tightly. The top *d* is formed of steel, which would be annealed by being brought into contact with the red-hot iron.

In fig. 3 the foot *a*, web *b*, and shoe *c* are divided longitudinally, and the top *d* is formed with a tongue *f*, which is securely held between the halves of the shoe *c* upon the screwing up of bolts *g* and nuts *h*; *i* is a washer, held between the web *b* and nut *h*. If desired, the tongue *f* may be carried down between the halves of the web *b* far enough for the bolts *g* to pass through it. A layer of lead, india rubber, or other material softer than iron may be inserted between the shoe *c* and top *d*, and if desired, the upper surfaces of the shoe may be made slightly concave, and a thin strip or sheet of steel placed thereon, so as so act as a spring, and thereby compensate for any want of straightness in the rails.

IRRIGATION WORKS IN INDIA.

We see with pleasure that many projects for the extension of railway and canal communication are likely to be carried out in India. The increased development of her resources cannot fail to prove advantageous both to herself and England.

The Calcutta correspondent of the *Times* says:—Sir Arthur Cotton, the well-known Madras engineer, who after a short visit to India returns to England by steamer, delivered a lecture to the Bengal Chamber of Commerce on works of irrigation in India. He was a little bitter, and not always unjust, in his condemnation of the acts of the East India Company, and of the administration of the present Public Works Department, and he quite bore out the truth of the charge which, he said, Sir Charles Wood applied to him, of being a sanguine man. Still, Sir Arthur Cotton has acheived too much for the people and the revenue by his hydraulic works in his own Presidency; and his accusation that the Government make great works, like the Ganges Canal, which will not pay because a little more money is grudged to complete them, is too truly borne out by the late Lord Canning's minute, not to give weight to his words at the present time of transition from State management to private enterprise. He has been engaged to report on projects to be taken up by the East Indian Irrigation Company in Northern India without a guarantee on its capital. That company is at present at work in Orissa, but Sir Arthur Cotton contemplates a series of hydraulic works between Allahabad and Calcutta, which are the natural limits to the Ganges stream of irrigation and navigation. Major Dickens drew up a scheme for the irrigation from the Soane of Behar which, in Mussulmen days, was the garden of India. As the scheme involved more than a million sterling of expenditure, Sir C. Wood was asked by the Indian Government to recommend it to private capitalists. Sir Arthur Cotton has partially taken it up. By throwing a dam across the Soane, a little below the Grand Trunk-road, he says a line of canal can be led on a dead level for 170 miles to Allahabad. He would, by other parts of "the Behar project," not only irrigate 2,250,000 acres, but send an ample supply of water to Calcutta, where it is so much wanted, raising it to a pressure of 100 ft., so as to supply the highest houses. Then there is the "Oude project" for irrigating the whole area from Rohilcund to the Ganges, with the North-western districts of Bengal Proper. By leading water from Ronagunge, Calcutta would receive the produce of these rich and distant provinces. The contract for the Behar project between Government and the company has been approved, with modifications, by the Secretary of State, and is now with Lord Elgin. Thus definite projects for extensive lines of railway and canals of irrigation and navigation are about to be carried out, so as to make the most distant parts of long-neglected Oude and Rohilcund accessible. If you ask whether these projects will pay, I say all depends on the engineers employed and the supervision of expenditure combined. The East Indian Railway had clever engineers, but it was nobody's interest to check peculation, and so the line cost £16,000 a mile. Even where private contractors constructed a line, as in the case of the Eastern Bengal Railway, the cost was great, though nothing like this, both because of the scarcity of labour and the fraud of the labourers and their suppliers. The projects will undoubtedly pay if these two requisites are secured in the agents—skill and honesty. There is some truth in what Sir A. Cotton says. We spend nearly ten millions a year on public works, one-half of which is out of current revenue. Of this, one-half, again, is devoted to new and reproductive works, yet we do not keep a separate account of these, but lump up the proceeds with land revenue. If the accounts of any one work—say the Godavery irrigation canals—were kept distinct, then enormous profit would be seen; they would be completed, and their patent success would lead to the extension of similar works. He would put all our public works under a Board of Commissioners, but he fails to show that a mere change of name, or even organization, without a change of system, would effect any good. The Madras Irrigation Company, even with, and, perhaps, because of its guaranteed capital, has as yet done little. But this much is certain, that now the great trunk lines of railway, primarily necessary for political reasons, are approaching completion, works of combined irrigation and navigation should receive as much encouragement as branch railways.

EASTON AND AMOS' WOOD SAWING MACHINERY.

Messrs. Easton and Amos, of the Grove, Southwark, have just obtained a patent for an invention of improved machinery for sawing wood.

The object of this invention is to render sawing machines more efficient in their operation than heretofore. To this end, in order to secure the log from rising with the drag of the saw on its bed while being cut, the patentees keep it down by means of pressing rollers or bowles carried by vertical water cylinders, in which stationary pistons are inserted, their rods being pendent from a transverse beam of the saw-frame. The upper and lower ends of each cylinder are brought into communication by an outside pipe, which allows of the water which fills the cylinders to pass from one to the other side of the fixed pistons. The water forms an elastic packing between the piston and the lower ends of the cylinder, and serves to retain the bowles of the cylinders in contact with the timber when once lowered in contact therewith.

As this machine would be required to operate upon balks or logs of varying thickness, the cylinders C are fitted with a vertical rack, as shown in the engravings, in gear with pinions for raising and lowering the cylinders; by this means the position of the cylinders may be adjusted to suit varying sizes of timber. It will, of course, be understood that while the cylinders are thus being raised or lowered the water confined within them will slowly escape from one side of the pistons to the other, so as to allow of the vertical movement of the cylinders.

It will be seen on reference to fig. 1 that the apparatus consists of a fixed piston A, and moveable cylinder C. The piston A and its rod should by preference be of wrought iron, and is secured to the cross frame B of the machine so as to be firm and rigid. Upon this piston and rod works a hydraulic cylinder C, of such length of stroke as will admit of the largest size balk intended to be cut by the machine being placed beneath it. A press roll D is connected by a cross head E to the lower extremity of the cylinder C, and bears upon the balk of timber. The cross head E works in suitable guides so as to keep the cylinder C in its traverse truly vertical. A pipe F, provided with a stop-cock, opens a communication between the upper and lower sides of the piston; and in actual work the cylinder C is filled completely with water, the cock being closed very nearly, in order to give the requisite resistance. It will now be seen that should the saws at the up stroke "lay hold" of the timber, as they frequently do, so as to lift the balk from the machine bed, the effect of this sudden lift will be to raise the cylinder C slightly, and drive the water through the pipe F to the upper side of the piston; but as a great resistance will be produced by the water endeavouring to pass through the nearly closed cock, this resistance will effectually prevent the further rising of the cylinder and the jumping up of the timber. On the other hand, the cylinder must necessarily rise and fall to suit the inequalities of the timber, but such rising will be very gradual and moderate compared with the sudden lift produced by the "laying hold" of the saws.

In order to ensure the rapid falling of the cylinders so as to be always in contact with the timber, a small valve in the piston opening downwards is provided, so as to give free passage for the water between the top and bottom of the piston when the cylinder is falling. The valve will, however, prevent the passage of the water in the contrary direction.

It frequently becomes necessary to move or traverse the bed or table of the machine upon which the timber rests quickly to and fro—as in the case of returning for a fresh cut, for instance—and at such times it is desirable to have the saws themselves stationary for adjustment; this is ordinarily accomplished by providing a separate driving motion from the main shaft in cases where saw-frames are driven from a detached steam engine or other prime mover; but it is obvious that such an arrangement cannot be obtained in the case of a machine where the saw-frame and engine are combined. In such a case, or in such other cases where a separate driving motion from the main shaft cannot easily be had, the patentees employ a separate small engine J, fig. 2, provided with any ordinary reversing movement arranged so as to cause the bed to run in either direction. A lever K is employed to turn the starting cock of this engine in connection with the working pawls L of the feed motion, by means of the coupling rod and lever M, so that the engine cannot be started without throwing the pawls L out of gear, and thus preventing the possibility of accident to the feed motion. This coupling rod movement may also be connected with the starting lever of the traversing gear of the ordinary saw frames.

EASTON AND AMOS' WOOD SAWING MACHINERY.

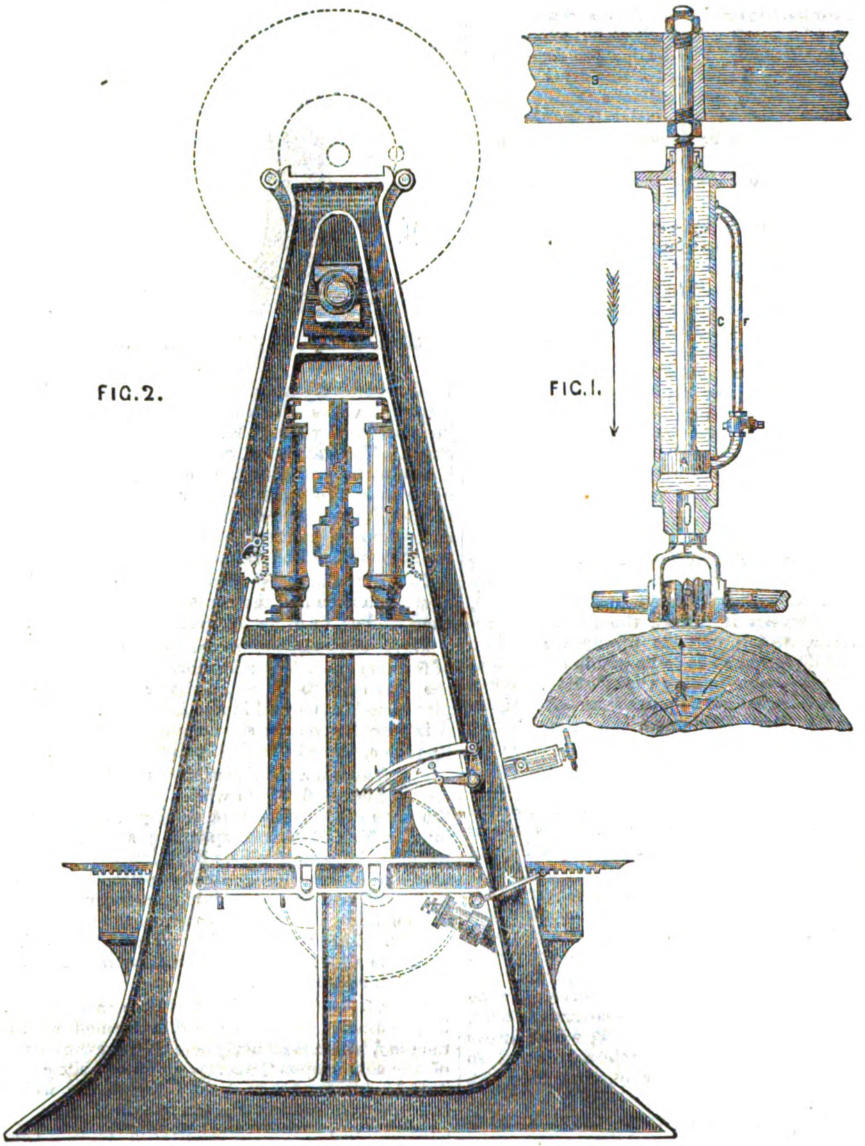


FIG. 2.

FIG. 1.

FAULDING'S IMPROVEMENTS IN LOCOMOTIVE ENGINES.

Mr. J. Faulding, of Euston-road, has patented some improvements in locomotive engines, which he describes as follows:—

The object of this invention is to obviate the inertia and momentum of the working parts of a locomotive engine, and my improvements consist in placing duplex oscillating cylinders C, C, on a horizontal line with the centres of the two driving axles I, I, in such a manner that the cylinders, with the whole working gear of the engines, are carried by an independent frame K, K, supported on journals L, L, on the two driving axles, so that the relative connections of the engines with the driving axles shall not be influenced in any degree by the play of the springs which carry the ordinary framing, boiler, &c. The piston rods are coupled direct to the crank pins F, F, which are fixed on the bosses of the driving wheels G, G. It will be obvious, then, that when the pistons D, D, are simultaneously driven outward, and by the return stroke are brought simultaneously towards the centre, the half of the power will be given to one driving wheel, and an equal power to the second driving wheel. The inertia and momentum of one piston will be perfectly balanced by that of the other, entirely doing away with the usual zig-zag motion of the locomotive caused by the action of the single piston, with its

FAULDING'S IMPROVEMENTS IN LOCOMOTIVE ENGINES.

FIG. I.

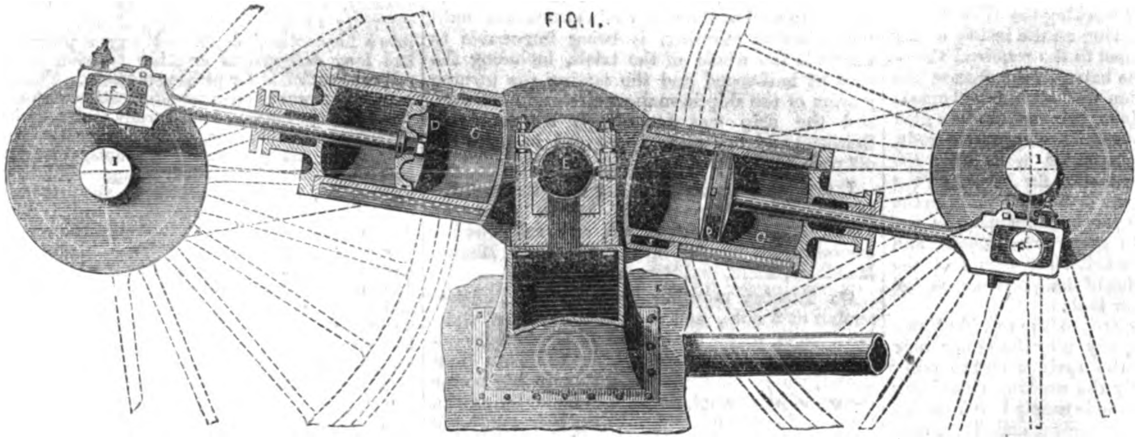
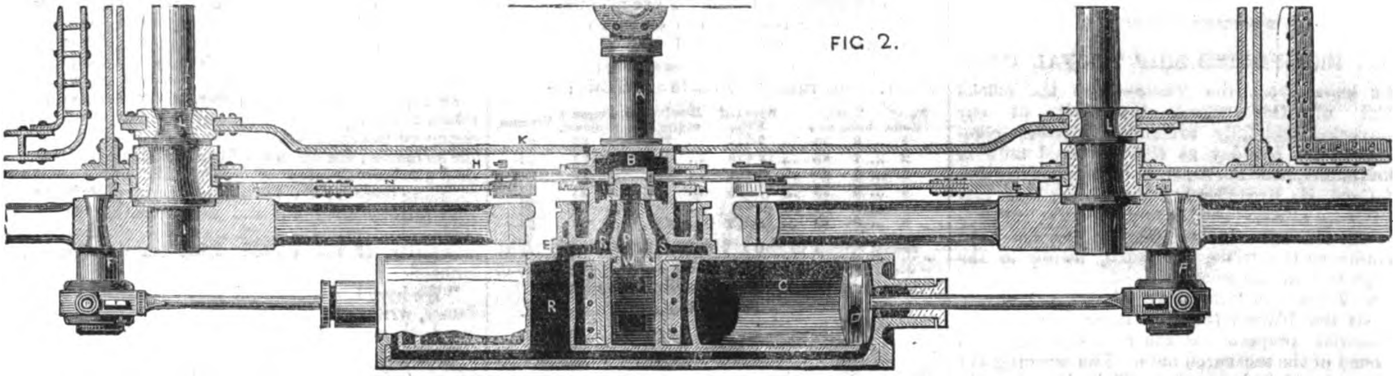
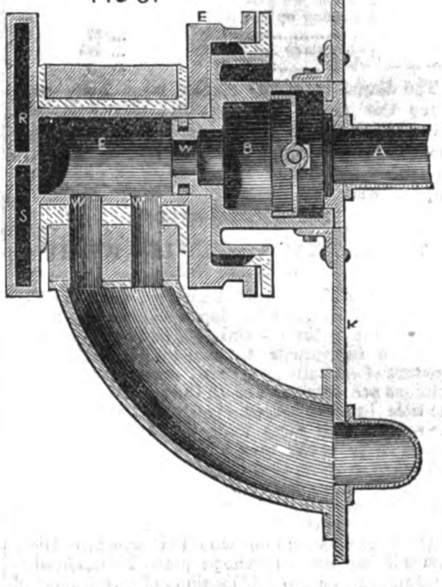


FIG. 2.



connections acting alternately on the cranks placed at right angles to each other, forcing first one driving wheel and then the other, and that the arrangement of the working gear, with the use of the single valve to each duplex cylinder, gives great compactness, and finally, that by so balancing the reciprocating mechanism of the engine, I obtain much greater steadiness at high speeds. In the first place, I take the steam direct from the dome on the top of the boiler by on oval steam pipe A, which I pass round the boiler to the underneath side, where it joins a pipe, the end of which is connected to the horizontal steam pipe A^1 to each pair of cylinders by a faucit joint and stuffing-box, the horizontal steam pipe being bolted to the flange of the slide valve casing fixed to the inner frame K, K. Thist arrangement is necessary, in order to allow for the up-and-down play from the action of the springs. I use two frames (as before stated) H and K, the inner frame being entirely independent of the outer frame, and to this inner frame I bolt the whole of the working machinery, including the cylinders. I bend the inside frame, where required, in order to clear the axle-boxes of the outside frame; on this inside frame I bolt the inside axle-boxes L, L, and thus obtain a rigid and independent foundation for the engine. I use two duplex cylinders C, C, placed on the outside of the driving wheels, and I join them at the bottom by a vertical flat steam chamber E, placed on the inner and outer side, and a circular cast-iron chamber placed transversely from these outside vertical chambers and joining the two, having openings W on the bottom side, which form a portion of the eduction passage; the circular chamber forms the trunnion on which the cylinders oscillate, and which works in the brasses of the plummer block, bolted to a curved wrought-iron bracket, which bracket is again bolted to the inside frame K, K, and, being made hollow, it forms the eduction passage for the steam to the exhaust pipe, in communication with the bracket on the inside frame K at one end, and the other with the blast pipe in the smoke box. It is clearly shown, then, that the cylinders being allowed to oscillate in their bearings fixed to the inside frame, are not acted on by any movement of the boiler, being independent of the action of the springs placed on the outside frame H, and on which the boiler rests. On the outside of the boss of each wheel I fix a crank pin, and I attach the piston rods to these pins by the ordinary straps and cotter, and the driving axles I, I, being straight, pass under and close to the barrel of the boiler. I cast a separate valve chest B, containing the steam and exhaust ports and passages, which I bolt to the inside frame K, and which, in fact, is a fixture, particularly that portion containing the ports on which the slide valve works, and which portion is square, or nearly so; but that portion which contains the steam and exhaust passages is circular, and projects into the trunnion of the cylinder. The joints of the connections between the two are made steam-tight; thus the outer one by the stuffing-box and gland, and the inside projection in the trunnion by a metallic packing consisting of a ring and spring with a bottom plate bolted on, as shown, similar to the packing of an ordinary piston.

FIG 3.



It will thus be clearly seen that, as the cylinders oscillate, the valve chest and ports remain stationary, allowing the lower portion of the steam and exhaust passages to move round them with a semicircular motion. I make one slide valve with the ordinary steam and exhaust ports answer the purpose for both cylinders, because it will be seen by the drawings that both pistons perform a similar duty, viz., front stroke and back stroke at the same moment; thus, when the pistons D, D, are at the bottom of their stroke and working simultaneously, the steam, after passing the valve, proceeds through the under passage of the front cylinder S, and acts on the bottoms of both pistons simultaneously. This steam, after having performed its duty, returns by the same passage to the exhaust port, and proceeds by the exhaust passages in the cylinder trunnion down the inside of the bracket to the exhaust pipe. The return stroke is made by the steam passing along the passage R over the back cylinder to the outside passage in the steam casing, which, it will be seen, communicates with both top steam ports, and the steam, acting simultaneously on the tops of both pistons, causes them to converge, and thus effect the return stroke, the waste steam passing along the same passage in return to the exhaust port. It will, therefore, be clearly seen that as the piston rods are connected to the pins on the bosses of the driving wheels, and as the pistons make a simultaneously outward and inward stroke, and the cylinders being allowed to oscillate on their trunnions, the two driving wheels revolve together either in a forward or backward direction, as required. The pins of the right-hand driving wheels are placed at right angles to the pins of the left-hand driving wheels; therefore, when the pistons are at the top stroke in the right-hand cylinder, the left-hand pistons are at half-stroke.

The arrangement for working the slide valves is this:—I bolt an iron ring on the inside of the boss of the driving wheel to the required throw of the valve, and place between the frames the ordinary slot link motion worked by a bell crank, which, acting on the links, brings them into gear on the slide valve rods and the eccentric rods, connected to the straps which work over the eccentric rings, the connection for reversing the engine being made by the ordinary handle on the driving platform. By this arrangement of the slide valve gear, I gain great compactness, and the whole of the space below the barrel of the boiler (with the exception of that portion occupied by the axles) for a water tank.

The boiler being bolted to the outside frame resting on the springs, any play the boiler may have is received on the springs on the outer frame, and consequently the working machinery placed on the inside frame is totally free from this action, being totally independent and rigid, with free action to perform its work.

THE IRON-PLATED SHIP "ROYAL OAK."

WE learn from the *Times*—That the official trial of this vessel, the first of our converted and fully armoured frigates, commenced on Monday at the measured mile in Stokes Bay, near Portsmouth, under the direction of Capt. H. Broadhead, commanding Her Majesty's ship "Asia" and the steam reserve at Portsmouth. Two previous attempts had been made to commence the trials, but failed, owing to the rough state of the weather.

At 9 a.m. the "Royal Oak" steamed out towards the Warner Light, to clear her fires and otherwise prepare for the race over the trial ground of the measured mile. The morning was fine with a light breeze from W. by N., just sufficient to furnish a good draught to the fires, but not prejudical to the ship's way when going against it. On reaching the lightship her course was altered, the ship's head being laid for Stokes Bay, where the trials of speed with full boiler power were at once entered upon, and completed with the following results.

No. of Run.	Revolution of Engines.	Time m.	Time sec.	Speed of Ship in Knots.	Pressure of Steam.	Vacuum.
1	59	4	55	12·203	22lb.	22½in.
2	61½	4	40	12·500		
3	61	4	40	12·857		
4	61	5	2	11·920		
5	61½	4	30	13·333		
6	61	5	9	11·650		

First mean speed in knots, 12·351, 12·678, 12·388,1 2·626, 12·941; second mean speed in knots 12·514, 14·533, 12·507, 12·558. Mean speed of the ship, 12·528 knots. Draught of water; 23 ft. 1 in. forward, and 25 ft. 7 in. aft; displacement of hull, 7,400 tons.

In making the first run at the mile the temperatures were recorded as follow:—On deck, 68 deg.; in engine-room, 73 deg., 73 deg., and 76 deg.; in the forward stokehole—fore part 84 deg., middle 109 deg., and after part 113 deg.; in after stokehole—fore part 103 deg., middle 105 deg., and after part 103 deg.

In the sixth mile run they were as follow:—On deck, 69 deg.; in engine-room, 72 deg., 72 deg., and 75 deg.; in forward stokehole—fore part 91 deg., middle 120 deg., and after part 112 deg.; in after stokehole—fore part 102 deg., middle 104 deg., and after part 103 deg.

The speed attained by the "Royal Oak" must be considered in the highest degree satisfactory, in all the sense of the words, if it is considered that the ship's "official" estimated speed was set down as 11½ knots, and that she has actually exceeded that rate by over one knot per hour.

The steering of the ship is managed by a simple reversion to the old gun-room tiller, *i.e.*, a long straight tiller projecting from the rudder-head into the after cabin, in a line with the keel; and the manner in which the ship answered her helm on Monday satisfied all on board that the resumption of the old description of tiller has given back to our ships some considerable portion at least of their old power of answering the helm, even before the introduction of the screw.

At the close of the full-power runs it was resolved to anchor the ship again at Spithead until the following morning, it being impossible to conclude the whole of the trials, including the runs at half-speed and the testing the turning powers of the ship in making circles, in one day, and the ship was accordingly steamed into Spithead and her anchor dropped in nearly its old position.

It is almost needless to say that the working of the ship's engines and boilers gave the greatest possible satisfaction, and reflected the customary credit upon the manufacturers, Messrs. Mandslay, Field, and Sons, of Lambeth.

On Tuesday morning the ship weighed her anchor at 8 a.m., and soon afterwards left Spithead again, under the charge of Captain Broadhead, for clear waters outside the Nab light vessel, where she could be tested in her power of turning and completing circles under full steam. On reaching the desired position, however, a hot bearing was discovered, and the full-speed circles had to be abandoned, and the programme of the ship's trials for the day cut down to six runs, with two boilers (one-third the ship's boiler power), and two circles afterwards with the same power. The runs were made as follows:—

No. of Runs.	Time. min.	Time. sec.	Speed of Ship.	Revolutions of Engines.	Pressure of Steam.	Vacuum.
1	8	19	7·214	35½	22	24
2	7	43	7·775	40½	22	23
3	6	49	8·801	37½	19	24½
4	8	26	7·114	38½	22	23
5	6	46	8·867	39	22	24
6	8	43	6·833	38	22	24

Mean speed of the six runs, 7·979 knots. The circles were made under the same conditions of power, and yielded the following results:—

	Circle to Starboard.	Circle to Port.
Time occupied in getting up the helm	27sec.	30sec.
Angle of rudder	26deg.	23½deg.
Turns of wheel	3½	3½
Time occupied in making half-circle	3min. 42sec.	3min. 43sec.
Ditto, full circle	7min. 27sec.	7min. 50sec.
Revolutions of engines previous to putting up the helm	37	37
Revolutions afterwards	35	34½
Men at the wheel	7	8

The diameter of the circles were little over twice the ship's length. The ship answered every touch of her helm as quickly and sensitively as a cutter, and her powers in this respect form a wonderful contrast to any other of our screw ships of war.

TESTIMONIAL TO WILLIAM HENRY JAMES, C.E.

THE *Mining Journal*, of Saturday, in a leading article, of which the following is an abstract, brings under public notice the claims of two comparatively unknown individuals to be considered—the originators of our railway system. So many conflicting opinions are expressed as to the relative claims of the title by different engineers, that we approach the subject with some little hesitation, preferring simply to place the question in its present aspect before our readers, that they may judge for themselves. Still, we believe we are correct in stating that the James's have fully as great a claim on public gratitude as George Stephenson; and the eminence of the individuals who have attached their names in furtherance of the proposed Testimonial to the James's, is a proof little short of convincing of the accuracy of the statements contained in our contemporary.

"There is a little work, entitled 'The Two James's and the two Stephensons.' As a matter of duty, the columns of this Journal were opened, many months since, to the discussion of its details. Upon the principle of justice between man and man, we laid the whole state of William James's case plainly before the public. That William James was 'the first great agitator and originator of the system of passenger transist on railways,' is made as clear as noon-day by the evidence adduced; and that George Stephenson was indebted to him for that inspiration which sent his, at that time, untutored intelligence hovering over the project organized by James, and upon which the evil destinies of the latter permitted it to swoop and to surge with rapacious appropriation, is equally apparent.

"The primary object of William James in making a tour of inspection through several parts of the country, where the tram-engines were used, was avowedly to find one 'capable of being converted into a locomotive,' fitted to the great purposes he had long designed of creating traction speed on railways sufficient for passenger traffic. This talisman, which was to open communication with all the wealth of the empire, he naturally took occasion to [illegible] with Stephenson, whose constructive genius a man of his penetration promptly discovered, and as readily, in warmth of appreciation, paid homage to, its tribute confidence the first impulse of a high cast, ingenuous mind, of which William James was, it appears, indubitably the possessor. The result was exactly as any foreseeing man might have indicated. In the Killingworth conference James lost his native secret of fame and fortune, and George Stephenson found it. Well; and more, he used it as a shrewd and clever man would, but he seems to have lost, in his upward course, certain sympathies for his benefactor, which would have been moral lights upon his way.

"Regrets, however, are now unavailing; what we would arrive at now is the best means of evincing our estimation of the services of the late William James, who was, in our opinion, the true 'Father of Railways.' His great competitor, George Stephenson, adopted the paternity; and far be it from us to undervalue by a hair's weight the benefits his wonderful ability conferred, not only upon this country, but many others; nay, to depreciate him would be injuring the reputation of James, of whose claims on the British public we are unhesitatingly the advocate; for when the former was but a struggling uneducated man of genius, the latter was spending fortunes on the advancement of mining and railway interest, and indoctrinating those engineering principles whereon the commercial prosperity of the United Kingdom is mainly founded.

"We have had submitted to us a letter of Mr. James, written in the year 1822, and addressed to Mr. Losh, of the firm of Losh, Bell, and Company, Newcastle, in which this paragraph occurs—'I wrote to Mr. Stephenson, to request his father to consider the best form and mode of engine power and carriage for conveyance of passengers and light goods, with the utmost dispatch, between these towns' (Manchester and Liverpool). Here, again, is afforded evidence of the precedence this project had in the mind of James as compared with the design of Stephenson, who estimated the acquirable velocity at only three to four miles on the level, and ten miles as the maximum running down an available incline.

"The Government of a country like this, so vast in its resources, so much indebted to engineering for its dominant position, so responsive in benevolence when its sympathies are legitimately appealed to, should turn no deaf ear to the claims put forward by the surviving representatives of William James. The day is now past for procrastinating, and whatever it may appear desirable to do should be done quickly; to palter with demands for assistance, when they proceed from those who have been depressed in circumstances—all but reduced to penury through the unselfish zeal of a father, who wrought and wrought materially for his country's good—would be unworthy of our governing powers, and disapproved by the people.

"It may here be inquired, why has so long a time been allowed to elapse without memorializing in the proper quarter? An honest and laudable pride keeps many a worthy man mute, but years have a modifying and mellowing influence on the improvident intolerance of the spirit, and induce it to accept that staff in the evening of life it had spurned in the mid-day.

"We understand such a feeling of independence, under no very easy circumstances, either marred the intent of a committee of the first engineers of the period, with Robert Stephenson, M.P., C.E., at their head, the purpose being a general subscription for James's family. 'In consideration of their father's public services as the original projector and surveyor of the Manchester and Liverpool Railroad, and many other of the most important railroads in this kingdom, principally at his own cost. We being of opinion that the great benefits conferred upon this country in particular, and the world at large, by his successful exertions and great pecuniary sacrifices, to the injury of his family (who are thereby deprived of all patrimony), entitle them not only to public sympathy, but also compensation, it being an acknowledged fact that to their father's labours the public are indebted for the establishment of the present railway system.' So ran the text of the document sworn to before the Lord Mayor on the 24th of June, 1846.

"Can Crown, Government, or people require more assuring testimony of the worth of a man whose services they are morally bound to acknowledge by a state provision for his children?"

Meetings for the Week.

THURS.—*Inventors' Institute.*—"On the Inadequacy of the existing Courts for the Trial of Patent Causes and the Necessity for Establishing a Special Court," by H. Williams, Esq., at 8 p.m.

FRI.—*Architectural Assoc.*—Special Business Meeting, at 8 p.m.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions, and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

G. H. A.—Mr. Gisborne's address is 3, Adelaide-place, E.C.

R. P.—You can continue to use your lathe without infringing the patent you refer to. There is a sad deficiency of books on turning, and, as you have already tried Holtzapfel, and found him wanting, we scarce know where to advise you to look. Perhaps Messrs. Lockwood could give you some information.

W. AUSTIN (Milford).—The style of your letter was scarcely suited to our pages. If you will kindly confine yourself to a statement of your views and what you propose, without too much animadversion on existing arrangements, which neither strengthen a cause or display good taste, we will insert a short letter. The firm of Brown, Lennox, and Co., Millwall, can supply you with information on chain cables; and Mr. Bennet Woodcroft, of the Patent Office, will forward you the specifications you want if you address a line to him.

T. W. J. (Stockton).—The simplest rule we can give you for calculating the strain your cylindrical boiler will bear. is this—Multiply double the strain allowable on the iron per square inch (which should not exceed 5,000 lb.) by the thickness of the boiler plate in decimals of an inch, and divide by the diameter of the boiler in inches; the quotient is the proper working pressure. To find the thickness for a given pressure—Multiply the diameter of the boiler in inches by the required working pressure, and the four right-hand figures of the product is the proper thickness in decimals of an inch.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

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MARINE ENGINE IMPROVEMENT.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—I have read with much pleasure your article upon Marine Engine Improvement, in your last number, and the only wonder is, that this important department of mechanical civil engineering has not made greater progress up to the present time. The great and unnecessary weight and space occupied by marine engines have long attracted the serious attention of my brother and self; and when the Royal Mail Company started, I proposed that they should adopt engines of a much lighter construction, but equally strong and effective as those which they ultimately employed. I pointed out, at the same time, the defects of the old system, and that in a very few years they would be obliged either to build new vessels with improved engines, or to take out the old engines and replace them with new engines of a lighter and more improved construction. My advice was not attended to. The old heavy side-lever engine, with great masses of cast iron, was adopted, so that the vessels scarcely attained a speed of eight knots, with a great unnecessary consumption of fuel and reduction of cargo space. As I predicted, in a very few years they were obliged to remodel their fleet upon the principles which I recommended, at a large additional outlay of capital; but, notwithstanding this, there is still considerable room for improvement.

About thirty years ago, I was consulted by the Admiralty, as to the advantage of employing steam at a higher pressure than that which they were then using—namely, 5 lb. per square inch. I strongly recommended them to employ steam of 40 lb.; and I understand that they have now got up to 25 lb. This is certainly an improvement. Still they are a long way behindhand.

You have justly instanced the locomotive engine as an example where a far greater amount of force is developed in proportion to its weight than the most improved marine engine which has yet been constructed. Some years ago, my brother and myself designed and constructed engines for one of the royal yachts, the "Elfin," of the nominal power of 40 horses; but which worked up to the indicated power of 254 horses; whilst the total weight of the engine and boilers, with water, was only 30 tons. These engines, although light compared to those hitherto employed, may be much improved, and with steam of much higher power a far greater result will be obtained.

I trust, therefore, that you will pursue this important subject, for a wide field is open to those who are ambitious to excel in the advancement of steam navigation.

I am, your humble servant,

London, June 16, 1863. JOHN RENNIE.

Miscellanea.

A memorial has just been presented to the Lords of the Admiralty by the Northumberland colliery proprietors, and they state that trials have been made, and it has been found that when North and Welsh steam coals are burned together in equal proportions, or with one-third of the latter to two-thirds of the former, no smoke is emitted. Mr. W. S. Lindsay, M. P., confirms the statement of the memorialists, and the Lords of the Admiralty have consented to make experiments with the view of accertaining the practical results of using North in combination with South Wales steam coal.

At a recent meeting of the Liverpool Dock Board, a report from the Marine Surveyor on some experiments made with petroleum was read. From this it appeared that the oil burned for ten minutes, giving a good flame, when an explosion took place, blowing the lamp to atoms. The lamp used was the ordinary lighthouse lamp as at present in use, and the disaster is partly to be attributed to the fact that the lamp in question was unsuited for the description of oil to which it was applied; but partly also, we should think, to neglect of testing the oil and the use of too volatile a quality of it. The degree of heat, however, may be so great as to render all such oils improper for such a purpose.

Sir Charles Trevellyan in his last budget wisely leaves to our Cheshire manufacturers the future supply of salt to India. Thus another of the few remaining relics of the old Company is gone, and we have a large increasing market permanently opened, to the great advantage of the salt trade, to the port of Liverpool, and to shipowners, to whom the carriage of 300,000 or 400,000 tons of salt is, most beneficial. This important result is in a great measure, due to the untiring efforts of the Salt Chamber of Commerce, seconded has they have been so ably and energetically by the members for South Cheshire.

Letters from Tripoli report that a company of French merchants established there have just entered into arrangements with a Manchester company for the cultivation of cotton on a large scale. A considerable extent of land is taken for four years, and a good breadth of cotton is already in the ground.

The "Charger" gunboat is ordered to proceed from Portsmouth to the Thames, where it will be placed in Messrs. Young and Magnay's dock, and fitted with a new description of propeller, patented by Mr. Curtis, of London, and from which great results are confidently predicted. The principle of the new propeller is an application of the universal or "shoulder" joint, by means of which the rudder and propeller are always in a parallel line. The inventor claims that by these means a ship will be able to describe a circle in little more than her own length, and all vibration from action of the backwater upon the rudder is effectually done away with. The difference between the new principle and the old is precisely the same as that which exists between the railway carriage with its fixed wheels and axles, and the ordinary road carriage with its pivoted axle and wheels.

The new cupola screw armour-clad man-of-war, launched by Messrs. Robert Napier and Sons, Glasgow, for the Royal Danish Navy, on the 6th of last month, after a most expeditious fitting out, came down the river on Friday last and proceeded to Gareloch to test her speed and have her compasses adjusted. She was under steam, assisted by only one tug, the "Chesapeake." After passing this the tug was thrown off and she steamed across to the loch herself. Her qualities as to speed tested thus far were of the highest order. She was sailing very fast and even distanced the tug, which is well known as a fast-sailing and excellent steamer. She then proceeded up the loch to run the measured mile. The "Rolf Krake," by which name she has been christened, is of very peculiar construction, being low in the water and of considerably greater breadth than is usual for vessels of her length. She is built from plans approved by Captain C. P. Coles, the inventor of the cupola war-ship. Her length is 185 ft., breadth 33 ft., depth 14½ ft., tonnage 1,246 tons. Her engines are of 240-horsepower. She is only some 5 ft. above the water line, with bulwarks to fold down in action, and she displays two revolving cupolas rising 4½ ft. above the deck, and 21 ft. in diameter. She is armour-plated from stem to stern, the plates being 4½ in. in thickness, and increasing to 7½ in. at the port holes, with the addition of 9 in. of teak lining inside. Her armament will be four 68-pounders—two in each tower, worked from the inside. The deck is entirely clear of obstruction, excepting the funnel and a small fixed tower aft for steering the vessel; in fact, the whole work is done under cover of armour plates, and she appears as one piece of solid iron from stem to stern.

One of the most novel of all public commercial companies is advertised in the Parisian journals--viz., La Compagnie Generale des Chiffons de Paris—a company to buy the produce of the street scavengers who pick up paper, rags, bones, broken glass, &c., in the public thoroughfares of that capital. The prospectus says that 25,000 people live by this strange trade.

The cost, amounting to £600, of the Bude Haven, Cornwall, new lifeboat establishment, has been presented to the National Lifeboat Institution, by the surviving children of the late R. T. Garden, Esq., of Rivers Lyons, Ireland, as a memorial of their beloved mother, Mrs. Elizabeth Moore Garden. An inscription recording this philanthropic gift has been beautifully carved in stone and placed over the doorway of the lifeboat house. The lifeboat is 33 ft. long, and rows 10 oars, double-banked.

There is a weed called the *sida retusa*, which grows wild in unfrequented streets and vacant places at Brisbane, in Eastern Australia, and was looked upon there as a pest. This weed has been found to yield a valuable fibre, and £30 a ton for 3,000 tons have been offered for it for shipment to England.

Mr. Cave, M.P., chairman of the West India Committee, has received a letter from Jamaica containing a scheme which has caused great interest in the island, for using rum, instead of spirits of turpentine, in the preparation of paint. The present price of turpentine is 10s. a gallon; that of rum in bond from 1s. 4d. to 2s.; but the duty amounts to 10s. 2d. in addition, and it is suggested that rum rendered unfit for drinking, either by a mixture of creosote or naphtha such as is now used in methylating spirits of wine, might be admitted duty free as a desiccant of paint, for which it has been proved by experiment to be well fitted. The revenue would not suffer, as the spoilt rum would come into competition with a duty-free article, and considerable relief would be given to the painting trade, which is in many places almost brought to a stand by the high price of turpentine. It is understood that Mr. Cave has brought the question before the proper authorities, and that it is still under consideration.

The Institution of Mechanical Engineers will make Liverpool the seat of their next annual congress. The meetings will take place in the first week of August; and an influential local committee, of which the late Mr. W. F. Macgregor was chairman, and Mr. W. Stubbs, C.E., hon. local secretary, met on Wednesday last in the committee-room of the Free Library, granted by the Library and Museum for the purpose. Mr. James Kennedy presided at this meeting, and preliminary arrangements were so far made. From these it appears that the London and North-Western Railway Company have liberally offered to place a special train gratuitously at the service of the Institution on Thursday and Friday, on which days it is intended to visit various works at St. Helen's, Messrs. Pearson and Knowles' Colliery at Wigan, the Railway Works at Crewe, and a Salt Mine at Northwich. The mornings of the first two days will be devoted to the real work of the Institution—reading papers upon scientific subjects in the Concert-room, St. George's-hall, which has been kindly granted for the purpose. The afternoons of each day will be spent in visiting various engineering works and places of interest in the town and upon the river. Among other attractions, Colonel Clay has invited the members to lunch at the Mersey Forge.

Gas Explosion at Blast Furnaces.—The *Birmingham Daily Post* says:—With a view to economize the consumption of fuel beneath the boilers at blast furnaces, certain makers of pig iron have adopted a plan for bringing down from the top of their furnaces certain combustible gases, that would otherwise go to increase the volume of flame issuing from the mouths of the huge structures peculiar to every iron-making district. The plan pursued is to insert a pipe of huge proportions, riveted together, as in the manufacture of a boiler, into the furnace near to the feeding gallery surrounding the summit, and to bring it down, after making a short elbow, almost perpendicularly by the side of the furnace. Through these pipes the gases are conveyed to the fires beneath the boilers. Unless care is used in the working of the apparatus, accidents are likely to happen, inasmuch as, with certain mixtures, the gases become explosive, and explosions not unfrequently occur. Such an accident happened yesterday morning at the Osier Bed Furnaces, near Wolverhampton, where, among other works in that district, the apparatus in question has been adopted. Here, at about half-past six in the morning, the monster pipe we have described was rended by an explosion of the gases passing through it, and a portion of the machinery attached to it was detsroyed, but no personal injury was sustained. The Osier Bed Furnaces being the property of Messrs. Sparrow, and the accident having happened near to the scene of the fatal boiler explosion which occurred last Saturday week at the finished ironworks of Messrs. W. and J. S. Sparrow, rumour attached larger proportions to the occurrence than it deserved. For some time there was a little alarm in the immediate district surrounding the furnaces; the consequences were happily not of a serious character.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 3079, 3081, 3121, 3128.
Boilers and Furnaces, 3109.
Ships and Boats, including their fittings, 3105, 3119.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3076, 3083, 3096.
Cultivation of the Soil, including agricultural implements and machines, 3090.
Food and Beverages, including apparatus for preparing food for men and animals, 3113.
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 3073, 3077, 3078, 3087, 3097, 3112, 3117, 3120, 3124, 3125, 3127.
Buildings and Building Materials, 3080, 3110, 3116, 3126.
Lighting, Heating, and Ventilating, 3072, 3093, 3099, 3104, 3108, 3123.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 3068, 3069, 3070, 3071, 3075, 3086, 3089, 3092, 3098, 3100, 3101, 3103, 3114, 3122.
Metals, including apparatus for their manufacture, 3094, 3106.
Chemistry and Photography, 3085.
Electrical Apparatus, 3074, 3095.
Warfare, 3084, 3091.
Letter-Press Printing 3111.
Miscellaneous, 3082, 3088, 3102, 3115.

3068. W. H. Andrew. *An improvement in scissors and shears.* Dated November 14, 1862.

This invention consists in fitting to the nail or back end of the blades of scissors and shears a clip spring in the form of a V or part of a V, the fore ends or end of which are or is attached to or secured by the screw or pin whereby the blades are united or otherwise. The object of the spring is to ensure contact of the cutting edges from heel to point when the scissors or shears are being used. *Patent completed.*

3069. S. Roberts. *An improvement in frames for containing stoppered bottles and jars.* Dated November 14, 1862.

This invention consists in fitting to frames for holding stoppered bottles or jars arms (moveable as hereafter described) over the stoppers of the bottles or jars held in the frames so close to them that the stoppers cannot be raised sufficiently to remove them from the bottles or jars; nor can the bottles or jars themselves be removed from the frame as long as the arms remain over the stoppers. The inventor applies a spring or other lock to a collar from which the arms project, and on opening the lock the arms are free to be moved into a position between the stoppers, when they, as well as the bottles or jars, may be removed from the frame. Instead of an arm being made to extend over every stopper, one arm may be carried out on each side of a frame, and a rod secured by lock may be fitted to each arm, which rods shall extend over the stoppers, and answer the purposes of the arms as hereinbefore described. The rods may be straight or circular or of other form to correspond with the shape of the frame. *Patent completed.*

3070. H. Morgan and J. Parkinson. *Improvements applicable to weighing machines, parts of which may be used to measure liquids.* Dated November 14, 1862.

This invention, when applied to weighing machines, consists in placing the counterpoise in a suitable vessel containing spirit, water, oil, mercury, or any other suitable fluid, and to which is attached a peculiar description of self-acting fluid indicator. *Patent abandoned.*

3071. V. J. Cassaignes. *Improvements in stereoscopes.* Dated November 14, 1862.

This invention consists, essentially, in producing the coloration of the stereoscopic image by means of a transparent coloured surface interposed between the picture and the eye of the observer, in such a manner that this presents two or a greater number of different tints. This improvement can be applied to all sorts of stereoscopes, and the inventor names chromo-stereoscopes all stereoscopes provided with it. *Patent abandoned.*

3072. C. Binks. *Improved methods of, and apparatus for, treating linseed and other oils and fats.* Dated November 15, 1862.

We cannot here give space to the details of this invention. *Patent abandoned.*

3073. J. S. Clegg and J. Slater. *Certain improvements in carding engines.* Dated November 15, 1862.

This invention consists in a novel arrangement and adaptation of mechanism for effecting the reciprocating motion to be given to the doffing comb. The doffing comb is secured at one end of a horizontal rod or lever, having a fulcrum at a convenient point between its extremities; the opposite end of this lever is furnished with a bowl or roller, which runs in an undulating or snail groove, that is, having a number of elevations and depressions formed in a disc or plate, so that, as this grooved disc rotates once round its axis, the doffing comb may be caused to vibrate any number of times, according to the number of elevations and depressions in the groove. *Patent abandoned.*

3074. L. Croc. *An improved ink to be used for the purpose of electric telegraph printing or marking.* Dated November 15, 1862.

The inks which the patentee has contrived to compose have the following properties:—They dry rapidly on paper, keep the inking plug or roller damp for one or more days, and yet do not dirt it. They have no corrosive action whatever on the metallic parts of the apparatus. They are solutions and not colouring matters in suspension in a liquids. Colouring matters: The patentee claims the use of all colours derived from aniline, which colours are three in number—red, violet, and blue. These colours he uses either separately or conjointly. Dissolvents: As dissolvents of the said colouring matters, he claims the use of the following liquids, viz.:—All bodies pertaining to the alcoholic series, the fixed or solid oils, the volatile or essential oils, and glycerine. Thickening matters: He makes use, as thickening matters, of resin, wax, and generally of all substances which are suitable to unite with the above liquids to render them thick or siccative. Dissolutions of aniline in the above-mentioned liquids yield coloured oils, and these, like all carburets of hydrogen, are instantly absorbed by paper, which they penetrate, forming outlines of perfect neatness. This property is very precious for quick transmission. The improved inks he uses either with Morse's apparatus, or the like, or with any printing type apparatus. *Patent completed.*

3075. E. Kirby. *A new or improved pulley for tightening the cords of window and other blinds.* Dated November 15, 1862.

This invention is carried out as follows:—To a plate which is fixed vertically on the window or other frame, two horizontal arms or brackets are fixed, one near the top, and the other near the bottom of the plate. A fixed vertical rod is supported at top and bottom by the said arms or brackets. The said rod is square, or of other angular figure, and has a screw thread on its angles. The axis carrying the roller under which the blind cord passes slides on the said rod, and a screw box or nut works upon the thread on the angles of the said rod, the said screw box or nut being above the sliding-piece to which the axis of the pulley or roller is fixed. The pulley and sliding-piece to which its axis is attached are supported by the blind cord which passes under the pulley, while they are prevented from rising by the screw box or nut. In order to tighten or slacken the blind cord, it is only necessary to turn the screw box or nut on the rod, when it rises or falls on the said rod, and forces down the sliding-piece carrying the axis of the pulley, or permits the said sliding-piece to rise. *Patent completed.*

3076. J. Rimmer. *Improvements in Hansom cabs.* Dated November 15, 1862.

The main objects of this invention are to prevent, or reduce to a minimum, jolting and vibration of the body and shafts, and parts thereto attached, of Hansom cabs, and to bring the horse nearer to the body of such Hansom cabs than has been practicable hitherto, and thus make them easier of traction or movement. To the body of the cab, close to the heel board, the inventor fastens a pillar or spindle, which he carries upwards through the curved or otherwise-formed hind part of the shafts, or through or between a shoulder or shoulders an eye or eyes or their equivalents thereto attached. On the said pillar or spindle he places one, two, or more helical or spiral springs, part of which is below and part above the shafts or shoulders or eyes thereon, and a sufficient number of nuts and washers or other arrangement for keeping the said springs in their places. The shafts are jointed by a pin or otherwise to fixed or rigid stays, so that, when the tyre of a wheel passes over a stone, or anything above the level of the road, or into a rut, or any place under the level of the road, the joints allow the shafts to move and maintain the same relative position to the horse, and the helical or spiral springs above and below the ends of the shafts receive the shock, and relieve the body of the vehicle from the sudden jolt and subsequent vibration so disagreeable in all Hansom cabs now made. The rigid stays to which the shafts are jointed or coupled do not require (when helical or spiral springs such as those already described are used) to be carried so far forward as in those Hansom cabs where springs are not used, nor as in those with long flat springs; consequently the horse can be brought back close to the bow of the shafts and to the body. *Patent abandoned.*

3077. A. and H. Illingworth. *Improvements in washing wool and other fibres.* Dated November 15, 1862.

In the washing of wool and other fibres, various means have been resorted to for carrying the fibre through the wash liquor, and amongst others it has been proposed to employ blades or plates applied to endless travelling bands or chains; but it was found that the tendency of such blades, by the continuity of their surfaces, was to produce a felting or matting effect. These improvements consist in substituting for such blades or plates prongs or teeth or grates, which may be of a curved or other suitable form, adapted, when applied to continuous travelling surfaces, or when in operation upon the fibre, to be continuously travelling in the same direction to carry forward the fibre through the wash liquid, and facilitate the washing thereof without felting or matting it. They also apply a series of prongs to the feed end of the wash trough to act as guides or conductors to facilitate the complete immersion of the fibre in its passage to the series of prongs, teeth, or grates. *Patent completed.*

3078. G. Sugden, J. Briggs, and J. Lockwood. *Improvements in means or apparatus for spinning wool, mohair, alpaca, and other fibres.* Dated November 15, 1862.

The object of these improvements is to give facility for the spinning together of fibres of different lengths of staple. For this purpose the inventors employ additional back rollers, one pair or set of back rollers being placed at a distance from the front rollers adapted to the longer length of staple, and another pair or set of back rollers at a distance from the front rollers adapted to a shorter length of staple. The roving of the longer length of staple presses between the back rollers farthest from the front rollers, and the roving of the shorter length of staple between the back rollers nearer the front rollers, and the two rovings then pass together to the front rollers to be spun together. They find it convenient to drive the back rollers conducting the roving of shorter staple in the opposite direction to those for the longer staple, and to pass the roving thereto first over and then between them. *Patent abandoned.*

3079. E. N. Duru. *An improved motive power engine.* Dated November 15, 1862.

This consists in employing mercury and water as the motive power, either separately or in combination in a specially constructed machine. *Patent abandoned.*

3080. H. B. Whitburn. *An improved material to be used in the manufacture of glass, and for other purposes where silica is used.* Dated November 15, 1862.

This improved material is sand, such as is found in this country; it is treated as hereafter stated. The sand to be treated by calcining or roasting it, which may be effected in a variety of ways; for instance, in the open air, or in close stoves, ovens, or in heat chambers or vessels. *Patent abandoned.*

3081. H. James. *Improvements in steam engines.* Dated November 15, 1862.

These improvements in steam engines consist—1, In the means of generating steam for the working of steam engines generally, more especially of very high-pressure steam for actuating engines hereafter described. The patentee effects the generation of steam by the injection of water, either in the shape of finely-divided spray or otherwise, into circular, square, or other shaped interstitial, vesicular, or cellular slabs or plates of metal, which he prefers to be composed of the best wrought iron. The internal cavities in these plates are united together by tubes or suitable projections thereon, which may be used also for regulating their distances apart from each other when placed over a fire in a suitable furnace. These hollow slabs or plates of metal have series of apertures or tubular openings through them in the direction of their thicknesses, to allow the smoke or other heated products of combustion arising from the fire after having impinged against their surfaces to pass through them into a chimney. These interstitial slabs or hollow plates may be formed of thin metallic plates, united together by series of very short tubes passing through them in the direction of their thicknesses, forming so many openings for the passage of smoke through them, and riveted or welded thereto, and to suitable pieces of metal placed between and around their outer edges, or may be properly moulded and formed in cast iron or other more suitable metal or compound of metals; or they may be otherwise formed by the drilling of holes through solid metallic slabs or plates in a parallel direction to their horizontal surfaces, and made to cross each other, so as to unite the several cellular passages so formed together, leaving, at the same time, sufficient spaces between these numerous intersections to admit of apertures being made through such slabs in the direction of their thicknesses for the passage of smoke, the end openings of the perforations around the edges left by the drilling being plugged and welded, or otherwise closed perfectly steam and water-tight. The invention consists—2, In an improved method or means of applying very high-pressure steam through the medium of water to the working of engines, which improved method constitutes a material modification of a portion of a former invention patented by the present patentee, bearing date the 4th day of September, 1855. *Patent completed.*

3082. J. Wilson. *Improvements in hydraulic pumps.* (A communication.) Dated November 15, 1862.

This invention consists—1, In injecting water by means of one or several pumps under a piston or ram loaded with weights, which the patentee terms a compensator, to form a self-acting hydraulic pressure, which can, in proportion to its size, be employed to feed any number of hydraulic presses. 2, In the peculiar arrangement of working the valves of the pumps. *Patent completed.*

3083. G. Gray. *Improvements in the manufacture of wheels.* Dated November 15, 1862.

For the purposes of this invention, a peculiar construction of metal nave is used, by preference of cast iron. Each nave is cast in two parts, in one of which the several mortises or sockets for the inner ends of the spokes are formed, and such sockets or mortises are made, by preference, with parallel sides, the mortises radiating from the centre of the nave. It is preferred that the angular parts of the nave which come between the spokes should be cast hollow, in order to obtain lightness. The second, or outside part of the casting simply consists of an outside cover to the nave, which is fixed to it by means of screws, the ends of which screw into an interposed disc or flat ring of wrought iron, and this disc or ring is fixed to the first-mentioned part of the casting by means of screw bolts and nuts, the heads of which bolts are countersunk in the disc or ring, and the screw bolts pass through holes through the angular parts of the casting which come between the spokes. In putting a wheel together, the wrought-iron disc or flat ring is put into its place, and so that it does not come in contact with the casting, but is held by moveable pieces a short distance away from it; the screw bolts are then passed through the ring and the casting, the nuts are then screwed up, and the ends of the wood spokes are driven into their places, the tenons being slightly taper. The flat ring or disc does not fit close around the cylindrical central part of the casting of the nave against which the inner ends of the spokes come when they are driven home, and the fact of their being driven home will at once be seen through the openings in the centre of the ring or disc. The spokes having been driven into their places, the outer plate is put into its place and fixed by screws to the wrought-iron disc. Should the inner ends of the spokes shrink, the disc may be tightened by the nuts. *Patent completed.*

3084. F. Palmer. *Improvements in projectiles.* Dated November 15, 1862.

This invention relates to a novel mode of constructing hollow projectiles, such as shells or projectiles to answer the purpose of canister or grape-shot. The object of the invention is—1, to construct a hollow projectile in such a manner that its flight shall be true and not erratic; and that, whatever the range may be, the projectile shall strike the object with the point or fore end foremost. This latter object is effected by distributing the weight of the projectile in such a manner that the fore end or forward half of it (except bomb shells, which must be spherical) shall contain a large excess, say about two-thirds, of the entire weight of the projectile. Another part of the invention consists in constructing the projectile of a series of single rings or compound rings, composed of two, three, or more single rings arranged and formed in such a manner that, on the projectile exploding, the rings shall be subdivided into a large number of pieces of nearly equal dimensions, and of such a weight that any piece by its mere gravity or weight when falling from a height, will be sufficient to kill or seriously injure a man. *Patent completed.*

3085. C. Binks. *Improved methods of obtaining oxygen and chlorine gases.* Dated November 17, 1862.

We cannot here devote space to the details of this invention. *Patent abandoned.*

3086. F. Raules. *Improvements in envelopes with the view to affording better security thereby.* Dated November 17, 1862.

This invention is carried into effect as follows:—The envelope, except as hereafter stated, is to be cut or formed in the usual fashion, by adopting flaps brought together and meeting in or near the centre, where the same are secured together. That flap, however, which is folded over the others, and is to be next to the letter or missive, is to be provided with one or more small tongues or projections (one in the centre being the most likely of adoption), the said projection or tongue, or projections or tongues, to be covered with adhesive composition on both sides by preference, so that, upon wetting the same as usual (the letter or missive having been inserted in the envelope), the tongue or tongues may be secured to the letter or missive, and to the envelope. The two other flaps next to the aforesaid flap may each be provided with a similar projection, tongue, or tongues, serving the same purpose. The topmost or opening flap is also to be provided with a small tongue or flap, which may be of ornamental shape, and of lacework, open work, or notched and covered inside with adhesive composition, the same to be wetted and secured to the outside of the envelope, the place where it is to be secured being by preference coloured, so as to be discoloured if wetted, in order to prevent the envelope being opened by steaming or wetting, without evidencing the same by injuring the lacework or open work, or by discoloration. It is evident that, to open this envelope, the last-mentioned flap must be opened, the flap detached from the tongue or tongues, and (if these be wetted on both sides) also detached from the letter or missive, before the same can be abstracted from the envelope; and, as the letter or missive when opened will adhere to the envelope, the two will remain together for evidence. *Patent abandoned.*

3087. W. Dobson. *Improvements in lace dressing frames employed in the dressing of lace or other fabrics.* Dated November 17, 1862.

In carrying out this invention, the inventor covers or protects the pins in the following manner:—He employs a strip or piece of wood, or other convenient material, of any required size and shape. This strip or piece he covers with flannel or other suitable material. The strip or piece thus or similarly covered, he places over the pins before mentioned, by which means he entirely prevents the possibility of injury either to the rollers or to the pins. The pins so covered will require to be washed less frequently than heretofore, and there will be less liability of the fabrics being damaged while being dressed. *Patent completed.*

3088. D. Thompson. *Improvements in screw cocks.* Dated November 17, 1862.

This invention has for its object the arrangement of the valve gear in screw cocks in such a manner that the joint between the thrust collar on the screw spindle and the surface of the valve box cover is rendered more or less perfectly water-tight, both when the valve is closed, and when it is open, thus enabling us to dispense entirely with the packing and gland usually employed for rendering the passage of the screw spindle through the valve box water-tight. *Patent abandoned.*

3089. W. Williamson. *Improvements in washing, wringing, and mangling machines.* Dated November 17, 1862.

This invention consists in simplifying the construction of washing, wringing, and mangling machines that are actuated by a crank or eccentric for the washing apparatus, and rollers for the wringing and mangling apparatus. Each process has hitherto been actuated by separate means—that is to say, the washing by means of a crank, actuating a reciprocating lever; and the wringing and mangling rollers by a separate arrangement, or by means of a series of toothed wheels—either apparatus for washing, wringing, and mangling being put in and out of gear as required. By these improvements the patentee abridges several pieces, and simplifies the machine for washing, wringing, or mangling. He makes the spindle which is turned to actuate the machine, and on which is the handle—or, if driven by power, on which is the driving pulley—the axis of one of the wringing and mangling rollers, and this roller will always rotate, whether using the machine either for washing, wringing, or mangling. A second roller supported in guides at its ends being under the top or actuating roller is brought in contact with the same when required for wringing or mangling, by turning a screw or screws that press on a spring or springs, or by an arrangement of weighted levers, and can be released from contact by lowering the same by means of the before-mentioned screws or levers. If the machine is required for washing only, it is necessary to place the end of the connecting-rod over the crank pin, and insert a cotter or pin in the holes at the end of the same, and lower the bottom roller out of contact with the actuating roller. If the machine is required for wringing or mangling, the patentee withdraws the cotter or pin, lifts the connecting rod off the crank pin, and turns the two screws, or releases the weighted levers that raise the lower roller, as before described, and the machine is then ready for wringing or mangling. *Patent completed.*

3090. C. Littleboy. *Improvements in implements for cultivating land.* Dated November 17, 1862.

The principle of this invention consists in the adaptation and attachment to any ordinary plough (whether worked by animal or steam power) of an instrument which breaks up the subsoil without turning it, and without interfering with the simultaneous action in the ordinary way of the plough upon the surface above the subsoil, such instrument being removeable from the plough at pleasure. *Patent completed.*

3091. G. Richards. *Improvements in the construction of ordnance and firearms, and in the projectiles to be used therewith.* Dated November 17, 1862.

This invention has reference to a previous patent granted to the inventor for a projecting rifling; and the inventor, in the specification of the present invention, shows how the same may be further developed by the adoption of various descriptions of projectiles suitable thereto, in such manner that the projectiles shall not derive their rotary motion by means of grooves or channels cut therein, as in the former invention, but that they shall be made so as to simply bear upon the surfaces of the projecting rifling, and thereby derive the requisite rifle motion from its spiral form or curve during their passage through the gun, whether a piece of ordnance, a rifle, pistol, or other firearm, to all of which the invention is equally applicable. Thus the projectiles may, in some cases, be made perfectly smooth on the exterior, and without either studs or grooves thereon, and they will be made to fit truly or evenly against the surfaces of the projecting rifling. *Patent abandoned.*

3092. J. Raphael. *Improvements in umbrella, parasol, sunshade, and walking sticks.* Dated November 18, 1862.

This invention consists in obtaining the above-named sticks from any wood cut from planks longitudinally with the grain, in lieu of from branches or off-shoots of trees, and twisting or bending the same in forming the handle or otherwise by steeping or soaking the ends thereof, firstly, in a warm solution of soda and water, and, subsequently, by means of heat applied thereto through the medium of a jet of gas or otherwise. *Patent abandoned.*

3093. J. Arbos. *Improvements in generating certain gases for lighting and heating, and in apparatus employed therein.* Dated November 18, 1862.

This invention consists—1, in the formation, as hereafter described, of a gaseous compound, and in mixing it, in retorts heated to a red heat, with gas arising from the distillation of coal or from the decomposition of fixed or volatile oils, resins, tars, or fatty bodies, to manufacture gas suitable for lighting and heating; and 2, in an apparatus for generating the gaseous compounds. The apparatus consists of a furnace lined with fire-brick, and by preference in the shape of an inverted cone with a circular grate at bottom, through which air, supplied by a blast, is admitted from a pipe below, its admission being regulated by a tap. There is a conical vessel, with opening at top, placed on the mouth of the furnace, through which coal or other fuel is introduced, and by which gas is allowed to escape at the commencement of the operation. As soon as inflammable gas is produced, the opening is closed by a conical stopper. A syphon tube passes into the furnace, through which tar, oils of resin, of schist, of petroleum, or liquified fatty matters are introduced when required. The gas generated in the furnace passes off by a tube from the upper part of the furnace into ordinary retorts, in which coal or oil gas is being generated. From these retorts the gaseous mixture passes through the condensers and purifiers to the gas-holders. *Patent completed.*

3094. P. N. Klein. *Machinery for turning or shaping metals or other substances.* Dated November 18, 1862.

This invention consists in the employment of machinery, as described with reference to the drawings, in combination with an ordinary turning lathe for shaping metals and other substances square or polygonal, instead of round or oval as hitherto. *Patent completed.*

3095. W. H. Burnett. *Improvements in the mode of working telegraph lines, and in instruments and apparatus employed for telegraphic purposes.* Dated November 18, 1862.

An extension of time for filing the final specification of this invention having been petitioned for, the documents relating to the invention cannot at present be seen.

3096. E. P. Houghton. *Improved application of breaks or apparatus for retarding or stopping railway carriages.* Dated November 18, 1862.

This invention consists in a partial displacement or disconnection of the engine or break van, either or both, or any other portion of the carriages forming the train, whereby the engine, break van, or other portion or portions of the train thus partially displaced or disconnected, sets in motion a break or breaks, or other appliances, which, acting on the wheels or other parts of the train, thereby impede its progress. *Patent completed.*

3097. C. W. Harrison. *Improvements in looms for weaving.* Dated November 18, 1862.

This invention relates to certain peculiar constructions and arrangements of apparatus for giving the necessary motions to the various moving parts of looms by pneumatic pressure, without requiring the intervention or complication of the parts ordinarily employed, and is carried out as follows:—1, The sley beam is actuated by means of connection with the piston rod of a cylinder, which communicates with a reservoir of compressed air, the air being admitted into the cylinder by suitable arrangements of valves, as in the ordinary steam engine. 2, The sley beam is constructed so as to move in a horizontal plane, each end working in a groove formed in the cheeks of the frame, and to avoid friction it is carried on wheels or rollers. 3, By means of suitable connections with the piston of the air cylinder which actuates the sley beam, the heddles receive their proper motions. 4, Motion is given to the shuttle by the direct action of compressed air, without the intervention of pickers and divers, as heretofore. This is effected by forming an aperture or chamber at each end of the sley beam, wherein the shuttle can wholly or partly enter, and by making an aperture in each check of the frame to which by proper connections compressed air is conveyed. As these apertures are brought opposite to each other by the motion of the sley beam, a suitable arrangement of valves is made to admit compressed air which shoots the shuttle. To reduce friction in the motion of the shuttle, the patentee forms the ends of the race of glass, porcelain, or other similar material, to which a smooth or polished surface is given; or he cases the shuttle therewith. To economise the propelling power, he sometimes construct the ends of the race of a tubular form, with a longitudinal opening for the passage of the weft. And 5, The motions for letting off the warp and winding on or taking up the fabric, are obtained by suitably formed connections with the piston of the air cylinder that actuates the sley beam. *Patent completed.*

3098. C. Neild and J. Hopkinson. *Improvements in fire-alarums and indicators of temperature.* Dated November 18, 1862.

This invention consists in the mode of starting an alarum when a room or building is on fire, by the consequent increase of temperature of the surrounding atmosphere. Within the building or room is placed a suitable vessel containing a fatty substance, or an alloy which retains a ball or weight; when the temperature of the building arrives at a certain number of degrees, the fatty substance or alloy will melt, and release the ball or weight. The base is so arranged that, when released, it runs down an inclined tube turning on a pivot or other suitable apparatus, and by turning the tubes on the said pivot releases a catch which retains a coiled spring or weight previously wound up, and thus starts certain mechanism to strike a bell, gong, or other alarm. *Patent completed.*

3099. R. Brown. *Improvements in warming and ventilating, more especially applicable to buildings, carriages, and ships, and in apparatus to be employed for that purpose.* Dated November 18, 1862.

This invention consists in ventilating buildings, ships, carriages, or other confined spaces by the employment of a light, which may be gas, or any other suitable light enclosed within a glass or glasses. If two be employed, a jacket will be formed between them. The light is supported by the vitiated air of the room or other confined space. *Patent completed.*

3100. N. Thompson. *Improvements in apparatus for* *stopping bottles, jars, and other vessels.* Dated November 18, 1862.

For the purposes of this invention the patentee employs a plate or disc of metal, or other rigid material, which by a screw is forced down on to the top of the neck of the bottle, jar, or vessel, a disc of some suitable compressible material being, however, interposed between the two surfaces. The neck of the vessel is made, by preference, cylindrical exteriorly for a short distance down, and in this portion of the neck a groove is made all round. To the neck thus formed a piece of sheet metal is applied, so as to extend half round the neck, and this strip of metal has its upper and lower edges turned inwards, so as to form flanges. The lower flange of the strip of metal enters the groove in the neck of the bottle, whilst the upper flange comes just above the top of the neck. This flanged strip of metal is secured to the vessel by another narrower strip of metal soldered or attached to it at the two ends, so as to form a ring encircling the neck, and this ring is lodged in another groove in the neck of the vessel, and prevented turning on the neck by teeth or transvere grooves being formed therein, into which portions of the ring are caused to enter, the ring being suitably indented for the purpose. *Patent completed.*

3101. R. Beck. *Improvements in reading-glasses and magnifiers to be simultaneously used with both eyes.* Dated November 18, 1862.

According to this invention the patentee makes a binocular reading-glass or magnifier by dividing a lens into two equal parts, and mounting the two parts at a short distance apart in a frame, but without in other respects altering the relative positions of the parts, except that with the highest power. He prefers to incline each part outwards to some extent, so that the axis of each half lens may be inclined in the direction of the object. *Patent completed.*

3102. J. Oxley. *Improvements in apparatus for separating liquid from substances.* Dated November 18, 1862.

The substances to be operated on are placed in an airtight vessel, made of iron, copper, or other material. The patentee connects an air-pipe to this vessel, and forces atmospheric air into the top part thereof; the air being thus compressed above the semi-fluid substances, gradually drives the latter through a pipe leading from the lower part of the vessel to a wooden or metal box or chamber placed near. In this box or chamber is a number of cloths folded like bags, having wire sheets or perforated plates, or both, between them, so that each pair of cloths is separated from others by the wire sheets or perforated plates. The effect of this arrangement is that the semi-fluids flow under the pressure of the compressed air into the centre of the cloths or bags, and by means of this pressure the liquid is expelled through the texture of the cloth, so that it runs away by the wire sheets or perforated plates, and out through the bottom of the box, leaving behind the solid residuum in the cloths. *Patent completed.*

3103. L. Lenzberg. *Improvements in the apparatus for raising and lowering Venetian and other blinds.* Dated November 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3104. H. J. F. Marmet. *Some improvements in the construction of lamps.* Dated November 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3105. J. Chalmers. *Improvements in the use, combination, and application of iron and timber, as armour for vessels of war and fortifications.* Dated November 19, 1862.

This invention is carried out as follows:—Commencing at the skin or side of the ship or wall or outer surface of a fort or work to be protected by armour, the patentee first applies what in the provisional specification of this invention is termed a cushion of timber planking, or other elastic or yielding substance, in order to lessen the rigidity of the structure, and to prevent the injurious effects of vibration caused by the impact of projectiles on the armour plates from destroying the frame and fastenings of the ship or fort, or the fastenings of the armour plates. Outside of, and covering, the said cushion, he attaches an outer plate or skin, which may be more properly termed an intermediate or second armour plate, which, when secured to the side of the ship or fort, will form a surface on which the compound backing hereinafter described will bear. This compound backing consists of alternate layers of timber planking and iron and steel ribs or plates, built up outside of the said armour plate. One of the edges of the said layers bears against the plate, whilst the other edge is presented as a support or backing for the outer or principal armour plate. He proposes that the said layers be bolted together laterally; and in order to secure a united body, and to facilitate the construction of this compound backing (especially when following the curved lines of a ship), he proposes in binding the said layers together to use bolts in short lengths with coupling nuts, which, nuts shall be of sufficient depth, not only to screw up the bolts which unite two or more layers together, but also to receive the ends of other bolts or lengths of bolts, which, in turn, after passing through two or more layers, shall in like manner be screwed up, and so on until the desired surface be covered. The ribs of iron may be plain plates of the size required, or of such a section as would tend to bind the layers together, so that when force was applied to their edges, they would act as a united body in resisting it. The planks in either case would be made to fit the ribs. He further proposes that the aforesaid layers be put together with an adhesive substance between them. The aforesaid compound backing as it is built up can be attached to the ship or fort by bolts in the ordinary manner, and the outer surface thereof formed by the edges of the planks and plates will form the bed or backing for the outer or principal armour plates. In applying these plates he would recommend that the surface of the backing and the inner surface of the plate be coated with a thin coating of india rubber, glue, or other suitable substance. In securing the armour plates to the ship or fort, he proposes to use first through bolts, with nuts and screws, either with or without a jam nut. And as the prevailing tendency of bolts subjected to the vibration caused by the impact of projectiles is to break at the thread close to the nut, rather than to strip or overhaul the thread, as frequently occurs when bolts are subjected to heavy strains, he proposes to use a shallow thread of the form generally termed a square thread, the depth thereof being only about half of the breadth. *Patent completed.*

3106. R. Mushet. *An improvement or improvements in the manufacture of cast steel.* Dated November 19, 1862.

This invention consists in adding to the materials or mixture of materials which, when melted, produces cast steel, spathose pig iron, or steel pig which has been granulated by the process of hot granulation described in the specification of this invention, whether the said hot granulated spathose pig iron or steel pig be used mixed with oxide of manganese, or the said oxide of manganese be added separately. *Patent completed.*

3107. S. S. Brown. *Improvements in elastic fabrics.* Dated November 19, 1862.

In carrying out this invention, the inventor moves the face of the framework knitting machine over its arch, then lays a thread of cotton, silk, or other material (supplied from beneath) across the needles, and fixes an ordinary jack or point machine to work in front of the frame. He then lays the points of the jack or point machine across every alternate needle, presses the points down so as to cover the beards of the said needles, drawing the jacks and sinking the frame so as to divide the loops made by the jacks, and brings the work to the needle beards, throwing the face of the frame upwards and backwards. After this he raises the points so as to enable the india-rubber or elastic thread to be drawn between the loops on the points and the loops on the needles. He then lays the elastic thread between the loops on the points and the loops on the needles, after which he brings the sinkers to the needle heads and then over the arch. Whilst going over the arch he removes the loops from the points, placing them upon the needles which the points pressed down whilst the jacks were drawn, or upon the adjoining needle when a change of pattern is required. He then removes the points from the sinkers, and places the frame ready for forming another set of loops in the following manner:—He supplies a thread of silk or other suitable material to produce the best side or outer surface of the fabric or garment, and places the said thread across the needles, then draws the jacks and sinks the frame face at the back of the needles to divide the loops and bring them to the needle heads, throwing the framework upwards and backwards, and leaving the thread in the needle-heads. He now presses down with the needle presser all the needle-beards, and brings the back loops to the needle-heads, moving the frame so as to bring the sinkers over the arch and be ready to form another set of loops. The set of movements first described for laying in the elastic thread must now be repeated and followed by the movements just described, and each set of movements worked alternately throughout the process of manufacturing the fabric or garment. *Patent abandoned.*

3108. J. Arbos. *Improvements in generating certain gases for obtaining motive power and in the apparatus employed therein.* Dated November 19, 1862.

This invention consists in a new gas engine, together with an apparatus for generating the gas, constituting one complete apparatus (as described with reference to the drawings), whereby motive power is created and transmitted; its characteristic feature is the production of a gaseous mixture composed of oxide of carbon, of hydrogen, of azote, and of a small proportion of carburet of hydrogen. This compound combined with air in proportions varying with its richness in carburet of hydrogen, and inflamed or exploded by an electric spark or by red-hot platinum wires, exerts inside a cylinder a pressure which becomes a motive power upon a piston therein, which power is transferred to the main shaft of the engine or apparatus to be transmitted or used as required. At the same time as the gaseous compound is generated steam is produced which may also be employed as a motive power, and may be used in a cylinder coupled with the gas engine. *Patent completed.*

3109. R. A. Brooman. *Improvements in tubular boilers, condensers, and superheaters.* Dated November 19, 1862.

This invention consists in the employment in boilers, condensers, and superheaters of helical instead of straight tubes. The tubes may have one or more turns in their length. The invention also consists in obtaining similar effects in straight tubes to those resulting from the employment of helical tubes by the fixing therein or thereon screw or twisted vanes. In boilers, however, in which the products of combustion pass inside the tubes, such vanes will not be applicable, because not being in contact with water they would be rapidly consumed. They apply, however, in condensers and superheaters, and may also be used in boilers with vertical tubes, round the outside of which the gases and products of combustion pass. *Patent completed.*

3110. G., C., W., and J. Kilner. *Improvements in means and apparatus for the manufacture of glass.* Dated November 19, 1862.

In the manufacture of glass the melting furnaces used are generally supplied with air from the "caves" or passages under the furnaces, and the fire-bars are covered with limestone to prevent in some degree the intense heat of the fires above corroding the bars. These improvements consist in keeping these bars cool by throwing jets of water upon them during the time of operating. For this purpose the water is conveyed through suitable pipes in the caves, and by pressure forced through perforations or nipples in these pipes in jets on to and between the bars, thus economizing the use of the fire-bars, dispensing with and saving the expense of the limestone, and producing a more intense heat in the furnace at a less cost of fuel by the vapour generated combining with the air of the atmosphere which passes through the furnace fires. *Patent completed.*

3111. J. B. Edmondson, J. Carson, and J. Blaylock. *Improvements in machinery for printing, numbering, and dating railway and other tickets.* Dated November 19, 1862.

The first part of this invention relates to those machines for which former letters patent were granted to Thomas Edmondson for printing and numbering railway tickets on the 19th March, 1850, No. 13,007. In these machines it has hitherto been customary to work the type-box and the numbering apparatus independently of each other, thus entailing two distinct operations of printing when the tickets had to be numbered at both ends. By these improvements tickets can be printed and numbered at both ends by one operation of printing, or one end only can be numbered or the numbers left out entirely, as may be found requisite. The second part of the invention relates to railway or other ticket-dating machines. In machines of this description it has been hitherto customary to supply ink to the types by means of a tape saturated with printing ink, such saturated tape passing between the face of the types and the tickets to be dated. By these improvements the tape is dispensed with, and the inking of the types is effected by means of an inking roller. The third part of the invention consists in using discs, in which slots or apertures are made for the purpose of inserting types, instead of using wheels or discs on which the dates are engraved as at present in use. *Patent completed.*

3112. R. Hardman. *Certain improvements in looms for weaving.* Dated November 19, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3113. G. A. Buchholz. *An improved mode of manufacturing semolina and flour, and apparatus to be employed in such manufactures.* Dated November 19, 1862.

The chief object of this invention is to obtain a larger per-centage of semolina, or of flour, from a given quantity of corn than is capable of being produced by the ordinary process of manufacture. To this end, the patentee first hulls the wheat intended to be converted into semolina in a novel construction of apparatus, the acting surfaces of which are formed of a peculiar arrangement of metal blades, which, when the apparatus is set in motion, give to the grain the friction requisite for removing the outer skin, or the greater portion thereof. When the grain has passed through this hulling machine, he separates the bran or hull therefrom by means of brushes, and afterwards submits the grain to the action of a novel construction of crushing roller mill, whereby a large portion will be reduced to semolina fit for the market. This he separates by means of sieves from those portions which still retain bran upon their surfaces, and the yet unbranned portions he submits to the action of mill stones, so set that they will impart only so much friction to the particles of crushed corn as will serve to destroy the adhesion of the bran thereto. This being effected, he next, by means of a dressing machine, separates the small portion of flour and semolina formed during the crushing and grinding processes, and by subjecting the semolina to blasts of air, he discharges the remaining bran therefrom. *Patent completed.*

3114. J. T. Hutchings. *Improvements in the construction of waterproof boot and shoe soles.* Dated November 20, 1862.

This invention consists in the application of leather to india-rubber or compound boot and shoe soles, which leather the inventor applies in a manner so as to form a border or edging to such soles. He selects soles of a size sufficiently small, so that, when the border or edging is attached, it shall be the required size; but, previous to such attachment, he destroys the uniform surface of the outer or top part of the sole, either by indenting, fluting, grooving, or perforating, which he does either by cutting, drilling, stamping, punching, or moulding. *Patent abandoned.*

3115. J. Jewsbury. *An improvement or improvements in machines for raising weights, which improvement or improvements may also be applied to lathes.* Dated November 20, 1862.

This invention consists in the application to machines for raising weights and to lathes of the mechanical arrangements hereinafter described, by which the motion communicated to a shaft or axis is reduced in speed and proportionately increased in force, in a simpler manner than by the mechanical arrangements ordinarily employed for that purpose. The patentee constructs a crab for raising weights as follows:—On an axis, turned by a winch or otherwise, an eccentric is fixed, the said eccentric carrying a pinion. The said pinion is loose on the eccentric, and square shoulders or pins on the said pinion engage in slots in an oscillating plate or arms. The said pinion has, therefore, no rotary motion. The said pinion is situated in, and engages with, a hollow-toothed wheel having one or more teeth more than the pinion. On each rotation of the axis carrying the pinon, the said pinion is carried round the hollow-toothed wheel, and causes the said toothed wheel to advance to the extent of one or more teeth. In order still further to increase the power of the machine, the arrangement described may be repeated—that is, the hollow-toothed wheel may carry an axis on the end of which is a second pinion, incapable, like the first, of rotary motion. The second pinion engages with a second hollow-toothed wheel, which carries a hollow axis working on the axis of the first toothed wheel. The said second toothed wheel advances to the extent of one or more teeth during one rotation of the first toothed wheel. The chain or rope by which the weight is to be lifted may be wound on the hollow axis of the second toothed wheel, or the said axis mary carry a pinion engaging with a rack. The application of the invention to pulleys for raising weights resembles, in all essential respects, its application to crabs already described. In applying the invention to a lathe, he makes an eccentric on the end of that part of the shaft carrying the driving pulleys, the said eccentric carrying a pinion incapable of rotation. The said pinion engages in a hollow-toothed wheel on the end of the shaft of the lathe head. The motion of the pulley shaft carries the pinion round the hollow-toothed wheel, and causes it and the lathe shaft to advance through the distance of one or more teeth on each rotation of the pulley shaft. The lathe shaft and pulley shaft may be coupled together and made to rotate at the same speed by throwing out of gear the oscillating plate or arms which engage with the shoulders or pins of the pinion, and connecting the two shafts together by a pin or otherwise. *Patent completed.*

3116. O. Stevens. *An improved brick-making machine.* (A communication.) Dated November 20, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3117. G. W. Oldham. *Improvements in preparing and dyeing silk waste, flax, hemp, Indian or China grass, or other similar or fibrous substances.* Dated November 20, 1862.

This invention consists, principally, in a peculiar method of preparing silk waste (or "husks" and "knubs"), flax, hemp, Indian or China grass, or other similar fibrous substances, for dyeing, whereby the patentee is enabled to dye the said materials either in black or colours, and sufficiently even in colour, previously to their being dressed or combed—that is to say, before being made into slivers, or before being mixed with wool or other fibrous material or materials—such fibrous substances having been hitherto invariably dyed after such operation. Secondly, this invention consists in dyeing such fibrous substances so prepared previously to their being dressed or combed—that is to say, before being made into slivers, or before being mixed with wool or other fibrous materials. *Patent completed.*

3118. F. Fletcher. *Improvements in the arrangement of a vessel or vessels for the compression of air as applicable to lift or force pumps.* Dated November 20, 1862.

In carrying out this invention, the patentee dispenses with the solid plank of wood, and substitutes in the place thereof a hollow box or frame of iron, or other suitable material, into which he inserts a suitable tube through a hole at the top, and on or against which box or frame he fixes the cylinder or barrel of the pump, and, if the situation require it, the handle or other apparatus necessary for working the same. This hollow box or frame of iron, or other suitable material, he makes into a vessel for the compression of air by inserting or attaching the delivery pipe thereto, by which arrangement a continuous flow of water from the delivery pipe is obtained while the pump is at work. The invention consists in using the above-named hollow box or frami for the purposes of a rest or support for the pump or pumps, and for a vessel in which to compress air. *Patent completed.*

3119. R. A. Brooman. *A method of, and apparatus for, indicating and recording the course of ships and vessels.* (A communication.) Dated November 20, 1862.

This invention consists in recording upon paper the actual course run by a ship by the combined agency of photography with natural or artificial light, the compass, and clockwork. The apparatus is called by the inventor a "Lozodrograph." In the binnacle, under the compass, clockwork is fitted for the purpose of unwinding paper, sensitized in any manner followed in sensitizing paper for the photographic process, from a roll, and of winding it on another roll. The rolls are placed on opposite sides of the binnacle, and the paper is drawn horizontally across and under the compass. A small object is placed upon the disc of the compass, say at the north pole, throwing down or projecting a very intense luminous point upon the sensitized paper. The effect produced is this—that, if the ship proceeds, for example, in a straight line from north to south, the luminous point will also trace on the paper a straight line from noth to south, and so on for all changes in the ship's course. Should the ship be compelled to turn round, the luminous point will trace an elliptical figure. The action is infallible; as the paper turns with the ship while the object remains stationary under the influence of the north pole. The speed at which the paper is made to travel being known, it becomes easy to ascertain exactly how long a ship has run ou such and such a tack. *Patent completed.*

3120. J. W. Child. *Improvements in means and apparatus for working wool and other fibres.* Dated November 20, 1862.

These improvements relate—1, To the use of glycerine or combinations thereof with oleaginous, fatty, or saponaceous matters, to facilitate the working of wool and other fibres in the various processes before weaving, either instead of oil, or in cases where the use of oil is, from various causes, objectionable. The improvements relate—2, When working wool by straightening or drawing the fibres thereof after they have been subjected to the combing process, to opening it by effecting partial separation or loosening of the fibres in a direction at right angles to the line of draught. For this purpose, the working teeth of the straightening or drawing apparatus employed have, in addition to their forward motion, motions at right angles thereto, and in opposite directions to each other. *Patent completed.*

3121. F. Leiler. *Improvements in motive power engines, and in apparatus for conveying and distributing motive power.* Dated November 20, 1862.

This invention relates to certain novel modes of applying compressed air, and to arrangements of machinery and apparatus for conveying and communicating motive power, to machinery more or less distant from the prime mover for raising and forcing water and other fluids, and for other useful purposes. The compressed air is not permitted, when thus employed, to escape after having once performed its work, as in air engines hitherto employed, but is enclosed or confined in the apparatus, and constantly used over again, and only such small portion of air as is lost by leakage, has to be replaced, and is, when employed, forced into the apparatus by means of a force pump. The greater the pressure of the air (consistent with safety) the more perfect is the action of the various apparatus. In carrying out the invention, the patentee makes use of compressed air of one uniform pressure, or he uses volumes or bodies of compressed air varying in pressure; he also uses compressed air in conjunction with water or other non-elastic fluids; and, lastly, he uses steam in conjunction with water and compressed air. The invention cannot be fully described without reference to the drawings. *Patent completed.*

3122. R. B. Seeley. *Improvements in inkstands.* Dated November 20, 1862.

For the purposes of this invention, in constructing an inkstand an ink vessel is used of the form of a nautilus shell, or other shell of the cephalopoda class, and the inventor makes such vessel of glass, china, or of other suitable material, and in some cases uses shells for the outer vessel. This vessel is mounted on axes, which are supported by and turn in bearings fixed on a suitable platform or surface. Into the opening or entrance of this shell-shaped vessel as large a dipping vessel or receptacle is introduced as the opening or entrance into the vessel will admit. Into this inner receptacle the ink is caused to flow, when the inkstand is about to be used, by simply moving the ink-vessel on its axis, so as to bring the open part of the vessel and the inner receptacle into a horizontal position, and the ink is caused to flow back into the interior of the shell-shaped vessel by a reverse motion of the vessel on its axis. The interior of the dipping vessel is lined with india rubber, or other suitable soft material, in order that the nibs of a pen may not be injured should they be dipped so deep into the interior or dipping vessel as to come in contact with the bottom thereof. In combination with the above construction of inkstands a frame is applied arranged to receive a piece of soft sponge, together with receptacles for a taper sealing-wax, instantaneous matches, and suitable friction or rubbing surface to ignite such matches. *Patent abandoned.*

3123. J. W. Hjerpe, W. Holmgren, and A. V. Sunstedt. *An improved composition or preparation of materials applicable for igniting matches.* Dated November 20, 1862.

This invention has for its object—1, to dispense with the use of phosphorus in the manufacture of matches, and also to prepare and apply the igniting ingredients in such a manner that matches cannot become accidentally ignited, and, in fact, cannot be ignited at all, except by being rubbed on a roughened surface especially prepared for the purpose. The improved composition consists mainly of chlorate of potash, bi-chromate of potash, to which may be added a metallic oxide, such as the oxides of iron, manganese, lead, or other metal, or a metallic salt. These ingredients are mixed and incorporated with glue, gum, or some adhesive preparations by grinding them up with the addition of a suitable quantity of pulverized glass, or other substance, to form a roughened surface that is sufficient to produce friction. *Patent completed.*

3124. W. Bottomley. *Improvements in machinery for stiffening woollen and other fabrics.* Dated November 21, 1862.

This machine is constructed of a width equal to the fabric to be stiffened. Across one end of the machine is fixed a perforated pipe, which is connected by another pipe to a cylinder of a pump of sufficient dimensions to contain the amount of paste or other stiffening liquid intended to be used. The cylinder of the pump is provided with a piston which may be worked backwards or forwards by means of a screw or rack connected with certain spur and bevel wheels; or it may be otherwise put in motion. The paste or other stiffening liquid is placed in the cylinder, and the end of the piece to be stiffened is carried under the perforated pipe, and as the machine is set in motion the piston presses the paste or other stiffening liquid in the cylinder through the connecting-pipe to the perforated pipe, and thence through the perforations in the perforated pipe, making the liquid exude in a uniform and steady shower, which falls on the cloth or fabric as it passes under the perforated pipe. The end of the cloth or fabric is then caused to pass between one or more pairs of pressing rollers in the machine, until nearly the whole length of the piece is sprinkled. It is preferred that the pressing rollers should be acted on by springs to cause the desired pressure. The two ends of the piece are tiod or fastened together, whilst the tail end has still to pass through between the pressing rollers, thus making the piece endless. The piece is passed several times continuously through the machine, until the stiffening matter is equalized in the cloth or fabric. The quantity of paste or other stiffening liquid to be applied to any given length of cloth or fabric can be exactly regulated by means of cog or spur wheels connected with the screw or rack, or other mechanism which communicates motion to the piston. *Patent completed.*

3125. W. Sinnock. *Improvements in the treatment and combination of fibrous and other materials, and in the arrangement of apparatus for manufacturing the same.* Dated November 21, 1862.

This invention consists in the treatment of hide offal and cuttings and shavings, and waste of manufactured leather, and in the combination of the animal tissue resulting therefrom, or in the combination of animal fibre (prepared by means well understood) with woollen or hair materials either spun, woven, or filled, or otherwise; or with vegetable fibre, half stuff or pulp, or by an admixture of the several materials mentioned in equal proportions, but which may be varied according to the subsequent use and application of such manufacture; and the treating or mixing the same with earthy or metallic chlorides, such as calcium, aluminium, tin, gums, resins, bituminous matters or substances, so that such compound materials may be either cast, moulded, felted, made, or compressed into suitable forms, such as sheets, slabs, blocks, or cylindrical rolls, which, when sufficiently solidified by the extension of all matters of solution, may be divided into separate or continuous sheets or webs of such compound fibrous materials. *Patent abandoned.*

3126. O. Hadfield and W. A. Attkins. *Improvements in compressing or dressing bricks and tiles.* Dated November 21, 1862.

This invention consists in the construction and employment of a revolving table or frame, upon or in which any convenient number of moulds, open at the top, and each fitted with rising bottom dies and pistons (actuated as after described), are placed, fixed, formed, or fitted, and a rising and falling main piston, actuated by a crank, and also working radially into and out of each succeeding travelling mould, passing respectively under the said piston as the table revolves. The travelling mould pistons are made in box form, open at the top to receive cushion dies; these pistons form the bottoms of the moulds in which they are accurately fitted, and are also caused to rise and fall therein more or less as required, and to operate by their upward pressure simultaneously with the downward pressure of the main piston working into and out of each mould as before described. The travelling mould pistons and bottom dies are actuated by two semicircular planes, fitted upon a bed plate under the revolving table, upon which inclines the said bottom dies and pistons are respectively supported and travel as the table revolves, and are thereby caused to rise and fall in the moulds. The sides of these moulds are made hollow, or in double case, to receive steam, hot water, or air for heating the same to prevent the necessity of lubrication. The revolving table and rising and falling pistons of the machine are actuated by suitable gearing driven by a steam engine or otherwise; and the bricks, tiles, clay, or other materials having been thereby subjected to the required compressing forces, and having received the desired form, are lifted out of the moulds by the continued rising of the bottom piston along the circular incline until it arrives at the highest point thereof, when the compressed articles are removed, and their place supplied by other materials. *Patent completed.*

3127. J. Townsend. *Improvements in damping and preserving vegetable substances, and vegetable and other textile materials and fabrics.* Dated November 21, 1862.

The patentee claims—1, The use of solutions of the compounds of chlorine with magnesium, calcium, and sodium, in conjunction or combination with the chloride or sulphate of zinc, or of tin, or with the chlorides or the sulphates of other metals, for preserving, or for damping and preserving, vegetable substances, and vegetable and other textile materials and fabrics, as described. 2, The using of solutions of sulphate of magnesia, in conjunction or combination with other sulphates of the metals, or of the alkalies, or with the chlorides of the metals, for preserving, or for damping and preserving, vegetable substances and vegetable and other textile materials and fabrics. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated Feb. 22, 1863.

502. W. E. Gedge, 11, Wellington-street, Strand. Improvements in the manufacture of hats. (A communication.)

Dated Feb. 27, 1863.

554. J. A. Coffey, 4, Providence-row, Finsbury, engineer. An improved method of, and apparatus for, controlling and facilitating locomotion whether on land or on water.

Dated April 2, 1863.

853. A. P. Price, 47, Lincoln's-inn-fields, chemist. Improvements in apparatus employed in the fusion, manufacture, production, and refining of metals.

Dated April 6, 1863.

867. W. E. Gedge, 11, Wellington-street, Strand. Improvements in aerial machines. (A communication.)

Dated April 24, 1863.

1027. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. A filtering apparatus for treating by pressure oils, syrups, and all sorts of liquids susceptible of filtering. (A communication.)

Dated May 7, 1863.

1143. G. Bower, St. Neot's, Huntingdon, gas engineer, and A. Dick, Alfred-street, City-road, chemist. Improvements in the purification of gas ordinarily used in illuminating, and in the reduction of ores and smelting of metals by means of such gas so purified.

Dated May 9, 1863.

1175. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in rotary engines. (A communication.)

Dated May 11, 1863.

1185. J. Shanks, Arbroath, machinist. Improvements in machinery for cutting or shearing the edges of grass or turf.

Dated May 15, 1863.

1225. R. T. Mallett, 11, Bridge-street, Westminster, civil engineer. Improvements in the construction of piers, walls, and other similar stuctures, and of landing stages, and in the constructions therewith or attachments thereto.

Dated May 16, 1863.

1231. R. Talbot, Strand-on-the-Green, Chiswick. A folding rudder for steering barges in the river Thames or coastwise.

1237. T. C. Stretton, Old Basford, lacedresser. Improvements in machinery or apparatus employed in the dressing of lace or other fabrics.

Dated May 19, 1863.

1251. J. H. Johnson. 47, Lincoln's-inn-fields, gentleman. Improvements in breech-loading firearms. (A communication.)

Dated May 21, 1863.

1274. E. T. Hughes, 123, Chancery-lane. Improvements in breech-loading firearms and in cartridges connected with the same. (A communication.)

Dated May 23, 1863.

1301. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in indicating the position of trains upon railways, and in apparatus employed therein. (A communication.)

1304. F. Kingsbury, Cecil-street, professor of singing. Improvements in the construction of orchestras.

Dated May 25, 1863.

1308. G. Howell, Old Kent-road, stationer. A new double-action self-feeding, stamping, and printing machine.

Dated May 29, 1863.

1350. W. Loeder, New Broad-street, City, merchant. Improvements in rails for railways. (A communication.)

1352. G. H. Pierce, Plymouth, gentleman. Improved apparatus for heating buildings by means of hot water.

1354. W. Green, Margaret's-place, Old Ford-road. Improvements in the means or method of producing black colouring matters or pigments.

1356. F. Patureau, Paris, manufacturer. Improvements in the manufacture of cardboard or paper boxes or receptacles.

Dated May 30, 1863.

1351. E. P. Mosman, Enfield Highway, engineer. Improvements in obtaining and applying motive power.

1360. V. Baker, Lieutenant-Colonel in Her Majesty's 10th Regiment of Hussars, Dublin. Improvements in ordnance.

1362. W. Clark, 53, Chancery-lane, engineer. Improvements in the manufacture of manure. (A communication.)

Dated June 1, 1863.

1368. J. Davey, Crafthole, Cornwall, agricultural implement manufacturer. Improvements in horse-rakes.

1370. C. Belcher, Little Coxwell, Berks, farmer. Improvements in cutting and transplanting turf, and in apparatus to be employed therein, which apparatus is also applicable to the extraction of weeds, and to the planting of seeds, roots, sets, or plants.

Dated June 2, 1863.

1372. J. Mellard, Rugeley, Staffordshire, agricultural implement manufacturer. Improvements in double moulding or ridging ploughs.

1374. J. H. Brierley, Beech-hill Mills, Halifax. The application of leather in the manufacture of gentlemen's scarfs and ties.

1375. D. Wilson, Wandsworth-common, and E. A. Cowper, 35a, Great George-street, Westminster. Improvements in presses.

1378. T. Page, Adelphi-terrace, civil engineer. Improvements in shoeing horses.

1382. T. Agnew, jun., Manchester, publisher. Certain improvements in apparatus for coating or covering moulded or other surfaces with certain composition or material.

Dated June 3, 1863.

1386. T. Claridge, Bilston, manufacturer. An improvement or improvements in the manufacture of spur wheels used in the construction of mill and forge gearing, and for other like purposes.

1390. J. J. McComb, Liverpool, gentleman. Improvements in the construction of presses for forming bales of cotton and other materials, and in the construction of fastenings for and means of applying bands to such bales. (Partly a communication.)

1392. J. Maurice, 3, Langham-place, Regent-street, dentist. Improvements in rulers and instruments for ruling and in the mode of constructing them.

Dated June 4, 1863.

1394. H. Rigby, Salford, engineer. Improvements in steam boilers and furnaces for the consumption of smoke.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated June 8, 1863.

1418. G. W. E. Friedrich, 14, Shap-street, Kingsland-road. Ink.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, June 16, 1863.

299. W. Clark. Armour-plated and other ships.

309. G. Harton. Wood paving.

312. T. Bradford. Washing, wringing, and mangling clothes or other textile fabrics.

318. W. T. Weston. Spring catch.

319. B. Russ. Iron ships or vessels.

335. G. Stevens. Effecting a regular supply of air or aeriform fluids for various purposes.

339. J. Price. Signal lanterns.

342. J. Cameron. Manufacture of iron and alloys of iron.

346. W. F. Cooper. Distilling apparatus.

351. M. Hackforth. Shades or reflectors.

352. G. Redrup. Cutting of shives, bungs, corks, spiles, and vent and other pegs.

361. J. Crossby and J. B. Smith. Carding fibrous substances.

363. R. Burley. Hammers, mallets, picks, mattocks, and similar tools.

368. A. Corneau. Hot-air stove.

371. J. Duckworth. Manufacture of paper.

375. W. Symington. Weaving.

378. H. Wycherley. Applying wings or dirt screens over the wheels of carriages.

387. W. E. Gedge. Promoting the comfort of persons at sea. (A communication.)

389. J. F. Spencer. Steam engines.

390. J. Robertson. Printing woven fabrics.

400. W. C. Paul and A. T. Shore. Spring mattresses.

403. W. Baylis and T. H. Hopwood. Tongs or forceps for grasping articles out of reach of the hand.

416. C. D. Abel. Omnibus. (A communication.)

464. C. W. Siemens. Telegraph line-wires.

480. H. Mackinder. Separating potatoes into different sizes.

789. G. Cowdery. Making bricks.

927. R. Leggett and R. Gittus. Cutting chaff and other agricultural produce.

1030. S. Harrison. Type.

1091. E. G. Brewer. Welding and rolling metals. (A communication.

1167. W. Boaler. Dryer fabric for paper making.

1185. J. Shanks. Cutting or shearing the edges of grass or turf.

1194. H. L. Emery. Ginning cotton. (A communication.)

1251. J. H. Johnson. Breech-loading firearms. (A communication.)

1313. H. B. Girard. Heating of every industrial and private apparatus by means of the oxygen and hydrogen gases combined and obtained from the decomposition of water.

1322. J. Munro and R. Scott. Boring, mining, and excavating or cutting in motive power engines, and in pressure gauges.

1382. T. Agnew, jun. Coating moulded or other surfaces with certain composition or material.

1418. G. W. E. Friederich. Ink.

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

LIST OF SEALED PATENTS.

Sealed June 12, 1863.

3345. M. J. Roberts.
3353. J. McInnes and E. F. Prentiss.
3354. J. Varley and J. Crowther.
3358. J. J. Lemon.
3359. W. and A. Smedley.
3363. R. Schomburg and A. Baldamus.
3364. H. Jörns.
3368. C. Defries.
3372. J. Ramsbottom and G. Hacking.
3373. J. W. Hawden.
3374. T. C. Barraclough.
3376. L. Latter.
3394. I. Holden.
3395. I. Holden.
3404. A. T. Blakely.
3419. J. B. Dalhöff.
3428. J. Whitley and J. W. Burton.
3462. J. H. Riddell.
3479. W. Clark.
306. T. L. Jacobs.
576. G. Haseltine.

Sealed June 16, 1863.

3379. G. A. Huddart.
3388. J. and A. Brierley.
3390. J. Savory.
3391. J. Longland.
3398. E. B. Wilson.
3399. D. Davidson.
3402. J. B. Morrison.
3409. J. Platt and W. Richardson.
3411. F. C. Bakewell.
3414. A. S. Stocker.
3416. E. R. Dann.
3430. T. C. Hinde.
3439. W. Clark.
3463. J. H. Riddell.
3481. R. Bottomley.
3489. F. Loret.
18. W. H. Muntz.
38. H. Chamberlain.
39. D. Nevin and W. Coppin.
61. T. Aveling.
83. W. Tasker.
117. J. A. Schlumberger.
201. W. Clark.
250. C. Mace.
587. J. Maxfield.
899. R. K. Penson.
1065. G. W. Fuller.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1432. H. Sommelet.
1434. W. B. and J. Farrar.
1448. W. Spence.
1571. W. Clark.
1474. H. Widnell.
1455. I. Whitesmith and and J. Steven.
1462. C. P. Coles.
1729. G. Spencer.
1496. E. L. Webb.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1373. T. Skaife.
1400. C. J. Duméry.
1424. J. Davis.
2427. A. G. Baylis.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending June 17, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
2976	0	10	3009	0	4	3018	0	8	3028	0	10	3037	0	10	3045	0	4
2981	0	8	3010	0	10	3019	0	8	3029	0	10	3038	0	6	3046	0	10
2993	0	8	3011	0	6	3020	0	4	3030	0	4	3039	0	8	3047	0	10
3003	0	4	3012	0	4	3021	0	6	3031	0	8	3040	0	8	3048	0	10
3004	0	4	3013	0	10	3022	1	4	3032	0	4	3041	0	4	3049	1	10
3005	0	4	3014	0	4	3923	0	8	3033	1	0	3042	0	4	3050	0	4
3006	0	4	3015	0	10	3024	0	4	3034	0	4	3043	1	0	3051	1	4
3007	0	10	3016	1	6	3025	0	4	3035	2	0	3044	0	4	3052	0	10
3008	1	2	3017	0	8	3026	1	2	3036	0	4						

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-bdgs, Chancery-ane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

METALS.

		£	s.	d.		£	s.	d.	p ct.
IRON:—									
Welsh Bars, in London	per ton	6	5	0	to	6	10	0	2½
Nail Rods	do	7	0	0		7	5	0	
Hoops	do	8	5	0		8	10	0	
Sheets, single	do	9	10	0		9	15	0	
Staffordshire Bars	do	7	10	0		8	0	0	
Bars, in Wales	do	5	10	0		5	17	6	
Rails	do	5	12	6		6	0	0	nett
Foundry Pigs, at Glasg, No 1	do	2	10	6		2	16	0	
Swedish Bars	do	11	10	0		12	0	0	2½
STEEL:—									
Swedish Keg, hammered	do	16	0	0		0	0	0	
Swedish Faggot	do	17	0	0		18	0	0	
COPPER:—									
Sheet & Sheathing, & Bolts	do	95	0	0		0	0	0	3
Hammered Bottoms	do	105	0	0		0	0	0	
Flat Bottoms, not Hamrd	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	8½	
Fine Foreign	per ton	94	0	0		95	0	0	
TIN:—									
English Block	per cwt.	6	2	0		0	0	0	2½
do Bar	do	6	3	0		0	0	0	
do Refined	do	6	8	0		0	0	0	
Banca	do	6	14	0		6	15	0	nett
Straits	do	6	7	0		6	10	0	
TIN PLATES:—									
Best Charcoal, I.C.	per box	1	8	6		1	9	6	
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
LEAD:—									
Pig, English	per ton	20	10	0		23	0	0	2½
,, Spanish Soft	do	19	17	6		19	10	0	
Shot, Patent	do	23	10	0		0	0	0	
Sheet	do	21	10	0		0	0	0	
White	do	27	0	0		27	10	0	
SPELTER:—									
On the spot	do	17	12	6		17	15	0	nett
ZINC:—									
English Sheet	do	23	5	0		0	0	0	2½
QUICKSILVER	per btl.	7	0	0		0	0	0	3
REGULUS OF ANTIMONY:—									
French star	per ton	42	0	0		0	0	0	2½

TIMBER, duty 1s. per load, drawback 1s.

Teak......load	£12	0	£13	0	Archangel, yellow	£13	0	£13	10
Quebec, red pine	3	10	4	10	St. Petersburgh, yel.	11	10	12	0
,, yellow pine	3	10	4	10	Finlan	9	0	10	0
St. John, N.B., yellow	0	0	0	0	Memel	10	0	15	0
Quebec oak, white	5	10	6	10	Gothenburg, yellow	10	0	11	0
,, birch	3	10	4	10	,, white.	9	0	9	10
,, elm	3	10	5	0	Gefle, yellow	10	10	11	10
Dantzic oak	3	10	6	10	Soderhamn	9	10	10	10
,, fir	2	10	3	10	Christiania, per C.,				
Memel fir	3	5	3	10	12ft by 3 oy 9 in.				
Riga	3	0	3	5	Christiania, yellow	21	0	23	0
Swedish	2	10	2	15	DeckPlank, Dantzic,				
Masts, Quebec red pine	5	0	6	0	per 40 ft. 3 in.	0	14	1	4
,, yellow pine	5	0	6	0	PUMICE STONE pr ton	5	10	9	8
Lathwood, Dantzic, fm	5	10	6	10	OILS, &c.				
,, St. Petersburg	8	0	8	10	Seal, pale ...per tun	48	0	0	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					Sperm body	81	0	83	0
					Cod	50	0	51	0
					Whale, Sth Sea, pale	46	0	0	0
Quebec, white spruce	15	10	18	10	Olive, Gallipoli	59	0	60	0
St. John, white spruce	14	0	15	10	Cocoanut, Cochin	49	0	0	0
Yellow pine, per reduced C.					Palm, fine	36	0	35	10
					Linseed	45	0	0	0
Canada, 1st qual.	17	0	18	0	Rapeseed, Eng. pale	49	0	0	0
,, 2nd do	11	0	12	0	Cottonseed	33	10	42	0

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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TO INVENTORS AND PATENTEES.
MESSRS.
ROBERTSON, BROOMAN, AND CO.,
Civil Engineers
AND PATENT AGENTS
(Established 1823),
166, FLEET STREET, LONDON.
UNDERTAKE TO OBTAIN PATENTS FOR INVENTIONS.
PROVISIONAL PROTECTIONS
APPLIED FOR.
Specifications Drawn and Revised.
Disclaimers and Memorandums of Alteration Prepared and Filed.
Oppositions Conducted.
CONFIRMATIONS & PROLONGATIONS ON PATENTS SOLICITED.
Advices on Cases Submitted, Opinions as to Infringements, &c. &c.
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THE
MECHANICS' MAGAZINE.

LONDON, FRIDAY, JUNE 26, 1863.

ARMOUR AND BACKING.

Our readers are far too well acquainted with the results of the experiments conducted by the Armour-plate Committee, to require their recapitulation at our hands. They have demonstrated, in our opinion, plainly enough, that the result most to be dreaded from the shot of an enemy is the fracture of the bolts which serve to attach the armour to the ship's side. Little or no difficulty is now experienced in forming plates which will effectually prevent, for a time at least, the passage through them of any shot that has ever been propelled from a gun. Our great iron companies could supply armour 12 in. thick, were it expedient to use it; but the weight of such plates, putting their cost aside, is quite sufficient to prevent their adoption for ships much short of 10,000 tons burthen. They are, perhaps, in the present state of the gun question, unnecessary; 4 in. or 5 in. of good iron possesses an amount of resistance which is, for anything we can see to the contrary, sufficient to meet all the demands likely to be made on its endurance in practical warfare—that is to say, it is able, as a general rule, to prevent the entrance of shot into the interior of the hull, without the employment of exceptional ordnance, such as no nation with whom we are likely to go to war possess as yet, or at a range so close that the conflict would quickly become a question, not of shot and plates, but of cutlasses and revolvers.

All the experiments, then, hitherto undertaken, show plainly that it is not so much the penetration of individual plates which is to be feared, as the disorganization of the entire portion of the ship's side fired at. Thus, we find that, in the case of the best targets produced, although the shot failed to penetrate, they were able to destroy, and it required but a prolongation of the process to cause the total destruction of the objects fired at, which suffered so severely from the effect of even a few heavy shot fired at short range that they almost fell asunder. Iron-plated ships are, in fact, exposed to precisely the same evils as a stone fort. Shot cannot penetrate a wall 8 ft. or 10 ft. thick; but it can, if the firing is continued, cause the wall to crumble into a ruinous breach, however strongly it may be built, cramped, and bound together; and were the "Warrior" or "Royal Oak" exposed to continuous fire for twenty-four hours, at a moderate range, although it is extremely probable that single shot would not penetrate to their hulls while their armour remained on their sides, it is not difficult to see that after a little time this would fall away piecemeal by the breakage of the bolts, and the destruction of the side of the hull would follow as a matter of course.

The question is, in our opinion, not so much what is the best kind of plates, or the best thickness for them—that we regard as sufficiently settled for the present—but what is the best mode of fixing and backing them? Not so much on the resisting powers of the plates as on the strength of the bolts, does the invulnerability of the ship rest. The strain on the bolts depends almost wholly on the nature of the backing employed in combination with them. In this lies the gist of the question; for it is of little avail to use plates perfect in themselves if they are to fall off in the hour of danger.

The breakage of armour bolts results from a very simple cause; when a slab of iron, thick or thin, resting on a yielding support, is struck with sufficient force any place near the centre, the edges turn up and the plate becomes slightly convex. Thus, an armour plate, supported by an elastic backing, no longer remains flat when struck by a shot, even if the force of the blow is not sufficient to cause a permanent bending or deflexion, by overcoming the limit of elasticity of the plate; still that very elasticity must permit a certain rising of its edges from the backing, quite enough to tend powerfully to the fracture of any bolts holding them down; the region where the shot strikes is driven in on the backing; the *vis inertia* of the rest of the plate resists this; it is slightly, though not permanently, bent by the impact of each shot, as a consequence; and the prevention of this bending is the real purpose which backing should fulfil. Until that is accomplished, a strain must be thrown on the bolts which can hardly fail to occasion their facture. Were the entire surface of a plate struck at once, elastic backing would be practically perfect, as it would admit of sufficient motion to absorb the force of the shot; this is not the case, and in consequence rigid support becomes a necessity.

Although it is more than doubtful that we shall ever secure anything of the kind, in the fullest sense, still we may approach sufficiently near to it to reduce the strain on the bolts so much that it easily comes within their powers of resistance; for, even if we suppose the backing not so rigid as to wholly prevent the depression of that part of the plate which receives the shot, still it may yield so slightly that a strain, very moderate indeed, is put on the bolts. The rigidity of the one and the strength of the other would seem to be capable of being nicely proportioned; increased elasticity demanding a stronger bolt, *vice versâ*. A plate of iron, 4½ in. thick, fitted with mathematical exactness to the surface of a block of steel weighing, say 100 tons, might, we feel little doubt, be struck over and over again by shot without being penetrated or rising at the edges; the entire force of the shot would be to a great degree transmitted to the steel block; and even were the plate not very accurately fitted to it, still its support would be so great that little strain would be thrown on the bolts which affixed it.

The question then narrows itself into the construction of a backing rigid enough to prevent such a motion of the central portions of the plate, as will cause the edges to rise with sufficient force to break the holding on bolts; no amount of wood backing will ever effect this without such an increase in their diameter as would effectually preclude their use. Iron can alone supply the support armour requires. Combine it with wood, if need be, but let that act merely as an auxiliary—never, under any circumstances, as a principal. The proper form under which to apply the stubborn metal as backing is a problem for the naval architect to solve—whether in separate girders or plates fixed on the edge, outside of, and distinct from the hull, or in the shape of a great increase in the size of the ribs proper of the ship, just under the armour, time and experiment alone can decide; but, certainly, no consideration of a little extra weight should influence the decision. Of what avail is it to clothe a ship with 300 or 400 tons of armour, which hampers all her movements, and yet may be found useless in the day of battle? How much better to supply, if needful, 200 tons more of backing, if we can by that means secure her practical invulnerability; little difficulty would be experienced in saving the extra weight in the engines and internal fittings of the ship with positive advantage. We trust we shall not again hear the relative weights of targets used as a means of comparison when considering their applicability to the purpose in view, while so much weight exists inboard which could so well be spared.

FIXED RULES AND THE STEAM-ENGINE.

There are few subjects on which more books have been written than the construction of the steam-engine. The beauty of the scientific truths involved; the grace, so to speak, displayed in the movements of the finished machine; the fact of its being, to a great extent, the basis of our whole social system, the source, not alone of our wealth, but of our luxuries, the spirit ministering to all our necessities, could not fail to constitute it an attractive object to scientific authors. By some it has been handled poetically; by some, philosophically, scientifically, mathematically, popularly; by very few, sensibly; and in spite of the mass of printed matter which bears on the subject, considerable difficulty is experienced in gathering any really useful information from existing books. We need never be in doubt, it is true, on any matter connected with it, provided we are content to take certain guides, and trusting ourselves wholly in their hands, progress towards the results to which they would lead us; but if our minds are unfortunately so constituted that we cannot quietly submit to accept one guide, without inquiring into the merits of others, we at once find ourselves adrift, for each proposes to lead us to the same goal by roads differing widely in direction and smoothness. Such, perhaps, will always be the case, and we regret it, for the fact has proved more injurious to the steam-engine, and a more powerful cause of delay to its progress, than ignorance or direct prejudice on the part of the constructive engineer ever could have been.

The assertion that the steam-engine is, in one sense, the most imperfect source of power we possess, may be startling; little reflection is requisite to prove it true. We can hardly be said to possess any other mechanical source of motion, save falling water. Animal strength and the force of the winds may prove very useful under certain limitations, but they play a very inferior part in our manufacturing economy as compared with water. Both from the antiquity of the use of this power, and from the extreme simplicity and invariable character of the laws on which its energies depend, everything relating to it has become thoroughly well known; and very little difficulty is experienced in constructing a water-wheel which will give forth a useful effect or modulus, equal to 70 or 75 per cent. of the theoretical useful effect due to the fall of which we avail ourselves.

In the steam-engine, on the contrary, we find a machine whose entire success depends on the accurate acquaintance of the engineer, not only with laws scarcely yet well defined, but also with the exact applicability of each or any of them to certain cases and circumstances, which must always be exceptional, and vary with different engines. The question of fixed rules for steam-engine construction becomes as a consequence complicated to the last degree, and presents difficulties sufficient, in our opinion, to have long since banished them from anything pretending to be a sensible book. The difficulty of practically carrying out theory; our comparative ignorance of what theory really says truthfully on the matter; the exigencies of diverse situations into which the steam-engine has to be fitted, as travellers were on the bed of Procrustes—have all operated very effectually in preventing its average of useful effect, approaching even distantly to the practical perfection of the water-wheel or turbine. Instead of 70 or 80 per cent., we realize about 30 per cent. of the power due to the combustion of the coal consumed; in other words, we burn three times as much coal as we ought.

But one thing can set this great evil right; for it is a great evil, regard it as we may. Teach our engineers an accurate knowledge of the principles involved; but, for the sake of progress, banish for ever the collections of arbitrary and dogmatical rules with which the shelves of our libraries, and our brains are equally burdened. We do not mean to assert for a moment that certain rules are not useful; nay, we will go so far as to admit, that to a certain limited extent they may be absolutely indispensable; but this can only be the case when they are made use of for the purpose of avoiding grave errors, not as being in themselves guides to success. Their proper function is to point out the course of construction which is positively wrong, not that which is absolutely right. Their use once narrowed to this, their legitimate province, they become serviceable; in the present state of things, they are not only worthless, but to the last degree mischievous.

The steam-engine differs from nearly all other machines, in that its success depends, not on one, but a multitude of principles, each to a certain extent demanding the observance of certain rules of construction, most of which are incompatible one with the other when the various principles are combined to form a whole. Not so, perhaps, provided we had infinite space in which to erect our engines, but this not being the case, our assertion is in the main correct. Thus, a heating surface, as compared with grate surface, three times what it is now, would be very advantageous provided it were attainable on board our steam boats, but unfortunately it is not, because the principles which guide us in the construction of the marine boiler must submit to the influence of those which regulate the construction of a ship. To go further, apart from what we may term external agencies, we find internal features and working necessities, which frequently lead to wide deviations from correct principles, which may clash in their application, to such an extent that each must yield to the rest. We might fill volumes with instances of the kind, but they are so obvious as scarcely to need illustration at our hands. We will point out one. On correct principles of water-heating, we should deprive the waste gases from a furnace of all excess of temperature above that of the water within the boiler. So far so good; but, on looking further, we discover that to ensure rapid combustion, when that is nesessary, the gases must possess a very much higher temperature in order that they may ascend the stack with sufficient velocity.

In short, the more we go into the question, the greater we find the difficulty of applying any fixed or arbitrary rules to the steam-engine, the only *machine* which is commonly employed to supply motive power. The water-wheel and the wind-mill are *instruments* depending for their success, each on a simple principle. The steam-engine derives all its energy from many different principles, which permit not only considerable latitude individually in their application, but positively cannot be employed in combination, without, to a certain extent, sacrificing much that renders each most perfect. We ask then, how can fixed rules properly apply to a machine complicated in its form and a hundred times more complex in its principles? Were it possible to draw up a code of laws which would be applicable to every varying circumstance, different form, and varying purpose under which it is found, or to which it is applied, they would form a book so gigantic that it would be valueless; no one could read it, none comprehend it. Even were such a book compiled, and granted that it was absolutely perfect now in 1863, who could say with certainty that it would be equally correct in 1873? The last ten years have ushered in wonderful changes, and we feel little doubt that the coming ten years will produce results equally important.

The engine of James Watt bears little or no resemblance to the engine of the present day. His was colossal, magnificent, mighty in its appearance of power. The tardy giant certainly conferred blessings on the manufacturing world, such as no motive power which had gone before had ever done. But this giant was costly to keep, slow in his movements, and his size and beauty formed but a useless pageant. The condenser came to be looked on as the most essential part of the engine—the source of all its power. We, half-a-century later, have learned that it is but a useful adjunct, a means of realizing the last fraction of economy, but not in any way necessary or indispensable to the development of power from the combustion of fuel. But all the rules at present employed by steam-engine builders date back, with scarce an exception, to the reign of Watt, and are, as far as possible, forced into modern practice, whether applicable or not. As well might we retain the old hemp-packed piston, as the exact area of grate, or speed of piston, which the engineers of Watt's day gave us.

We may certainly apply empirical rules to the construction of a boiler, the speed of a piston, the height of a stack, &c.; but, *cui bono?* A different description of coals may render our boiler next to useless; the speed of piston adjudged to us may entail heavy multiple gear — a difficult situation may render expedient the employment of an engine constructed apart from all such rules. Of what avail, then, is it to print and publish, day after day, dogmas which can be of no general value, because they are not capable of general application? Why fix the speed of a piston at 300 feet per minute, when we find it do its duty equally well at 100 feet and 1,100 feet per minute? Why fix positively the area of a grate, when a little difference in the state of the air, in the quality of the coals, in the skill of the fireman, can alter the results obtained? Let our engineers rise above such narrow dogmatism; let them handle the subject liberally; let them study as carefully as they will the scientific truths involved in the working of every separate part of the machine they propose to construct; let them display their talents in the combination of these different parts, guided by an accurate and well-trained perception of that course of construction most suitable to the circumstances in which they have to act, not blindly following rules which alter not, like the laws of the Medes and Persians.

FRICTION.

There is a no more striking exemplification of the proverbial difficulty of mankind in arriving at truth, than that afforded by the apparently futile attempts of the physicist to explain the causes of daily and familiar phenomena. The answer to an inquiry as to what is Friction? appears simple enough; but, nevertheless, although few questions in natural philosophy have attracted more attention from the most powerful minds, the results have been scarcely in proportion to the labour that has attended these investigations. The first recorded experiments on friction were those made by Aumontons, in 1699. Then follow those of De la Hire, Parent, Leibnitz, Da Camus, Leupold, Sturm, Bulffinger, Desaguiliers, Muschenbroeck, Bossut, Ferguson, Dr. Vince, Coulomb, George Rennie, and Morin. The first observations on friction thus date more than a century and a-half ago; but not merely have we no generally received hypothesis that would completely account for the phenomena of friction, but the numerous experiments that have been made to clear up the question have only afforded us certain approximative values, often contradictory to each other, and as often only partially agreeing with practical experience.

The fundamental laws upon which engineers at present base their calculations as to friction, were determined about thirty years ago by the French *savant*, the then Captain, and now General Morin. According to Morin, the co-efficient of friction is independent of extent of surface and of velocity, and is in proportion to the pressure only. According to some fresh experiments lately made by M. Bochet, and recorded in the Memoirs of the Paris Academy of Sciences, friction diminishes with the velocity, while it varies with the surface rubbed—conclusions directly opposite to those of Morin, which have nevertheless afforded the data upon which engineers have relied for the last 30 years. We may here remind our readers that Ferguson also found that friction varied with the speed. This occurrence, however, is but a repetition of the preceding history of experiments in friction; the results of the experiments of Morin contradicted those of Coulomb in several ways, while the co-efficients and general results of Coulomb himself greatly differed from those of his many predecessors in this department of experimental science.

We hope to return to this important subject; but, in the mean time, we will allude to the various hypotheses that have attempted to account for the real nature of friction.

Most of these different theories have been collected together in an excellent treatise on friction, written by Herr Brix, of Berlin, and published some years ago in the "Verhandlungen des Vereins zur Befoerderung des Gewerbfleisses in Preussen."

As is well known, the surface of every substance in nature, however apparently smooth and hard, when examined under a magnifying glass, is found to consist of a series of little prominences and concavities—the ultimate particles of all bodies being always provided with interstitial spaces. The most generally received and popular explanation of friction is thus founded on the supposition that the prominences of each one of two sliding surfaces grip or catch into each other's concavities. An exaggerated picture of this would be given by imagining two toothed racks fitting into each other. When motion takes place, the asperities must either be bent and torn away from the surfaces of one or both of the two substances, or one of the two bodies must be continually lifted out of the inequalities of the other. This more especially applies to the sliding friction that takes place between two sliding surfaces. In rolling friction, as that of a ball or cylinder, the prominences are continually fitting into fresh concavities. The friction between an axle journal and its bearing is of a composite kind—between sliding and rolling friction. The theory deduced by Coulomb from his experimental researches is similar to the above, but of a more complete and detailed character. He supposes that the surfaces of woods, for instance, are covered with small elastic and pliable threads or fibres, which stick out like hairs on a brush, and can be bent in any direction; the surfaces of metals consist of angular or spherical inequalities, which, being hard and unbending, never change their form, whatever pressure may be applied. Starting from these data, Coulomb explains the peculiarities that take place when wood is rubbed on wood, metal on metal, and wood on metal. When wood is brought into contact with wood, the fibres of the one surface sink into those of the other, just as when the hairy sides of two brushes are pressed together, and this resistance against motion increases with the depth that the particles are sunk into each other. Metals, which are not covered with flexible fibres, but rather with hard unbending prominences and asperities, are impeded in their motion by these asperities interlocking with each other. The depth to which any of the substances will interlock with each, will be increased if they are left in contact for any amount of time. We have thus the explanation that the friction at starting, or of quiescence, is greater than when the surfaces are once brought into motion.

The effects of oil or grease in diminishing friction have been ascribed by Muschenbroeck to the fact that oil prevents the prominences on the surface from being broken off; as it consists of small globules which fill up the interstices, the elevations of the two surfaces are prevented from reciprocally grippihg into each other. The globular form of the particles of oil, being easily moveable, also facilitates the movement of the two surfaces. This last idea has been carried still further by the Abbé Rollet, who assimilates the lubricating power of oils to the action of rollers when placed under a heavy weight to move it along.

The celebrated John Leslie, however, in his work "On the Nature and Propagation of Heat," accounted for friction in a somewhat different manner. His theory, although remarkable for its ingenuity, does not seem to have attracted the attention it really appears to deserve. He rejects the explanation of friction upon the principle of the inclined plane; and that friction is produced from the effort required to make the weight move over successive series of eminences. "The mass which is drawn along is not continually ascending; it must alternately rise and fall; for each superficial prominence will have a corresponding cavity; and since the boundary of contact is supposed to be horizontal, the total elevations will be equalled by their collateral depressions. The force given out in lifting the weight up, is returned in letting it down again; and these opposite effects will thus neutralize each other." Adhesion appears still less capable, continues Leslie, to explain the origin of friction. As adhesion must be regarded as a force acting perpendicularly on the frictional surfaces of the solids, such a force can have evidently no effect in either quickening or impeding the motion along these surfaces. In his own words:—"Friction consists in the force expended to raise continually the surface of pressure by an oblique action. The upper surface travels over a perpetual system of inclined planes; *but that system is ever changing, with alternate inversion*. In this act, *the incumbent weight makes incessant yet unavailing efforts to ascend*; for the moment it has gained the summits of the superficial prominences, these sink down beneath it, and the adjoining cavities start up into elevations presenting a new series of obstacles which are again to be surmounted; and thus the labours of Sisyphus are realized in the phenomena of friction."

Not one of these theories may be said to properly account for the fact that friction in some cases will even exceed the weight with which the bodies are pressed together; and the numerous but unsuccessful attempts to arrive experimentally at definite laws, seem to point to something inherently defective in the means employed to approach determinate results. There is no doubt that friction is really a very complex phenomenon; as was remarked by Oersted, "There are many phenomena belonging to friction which are very far from being sufficiently explained." It is extremely probable that the comparatively new theories of thermal dynamics may shed some light upon the matter. Friction is one of the most powerful means of converting mechanical power into heat or electricity. Heat is always produced whenever friction is overcome, and the amount produced is the measure of the force expended in overcoming the friction. To neglect these transformations of power, would evidently often vitiate the results of the experimenter on friction. It has been noticed during these experiments, that with metals friction is increased by the temperature being raised; and, with woods, that it is increased when the material is damp. Nothing more definite than this general law has been as yet ascertained.

THE MANUFACTURE OF ARMOUR PLATES.

The history of the arts of peace affords many instances of their indirect advancement and extension through a parallel progress of the arts of war. Many examples of this fact could be cited. Confining ourselves to the history of the iron manufacture, we will merely recall to our readers that the first iron-castings in England consisted in some cannon for Henry VIII., and, coming to more modern times, that Mr. Bessemer made his first experiments in casting steel with a view of obtaining a good metal for heavy ordnance. Wars and rumours of wars have always acted as stimuli to invention; and the immense interests involved in the success or failure of a conflict of nations, have often directed the whole resources of a country towards the overcoming of a physical obstacle. The unlimited capital and resources, the complete organization of a Government, are directed into channels that, in times of peace, would have to be filled by the limited exertions of a few private individuals.

The youngest mechanic can remember the time when the production of large masses of wrought iron was a very difficult and uncertain process; while he can also recall to mind the failure of Mr. Nasmyth, the steam-smith *par excellence*, when attempting to forge a heavy piece of ordnance. The most inexperienced and unimaginative mind can also perceive the immense stride, the complete revolution, that would result to engineering if we could only obtain solid wrought iron for the many structures we are now compelled to build up out of separate parts. We are still very far from the goal; but everything tends to show us that in a few years we shall attain an immensely increased command over the production of wrought iron in large pieces.

That the large iron slabs now in demand for armour-plated ships will continue to be required, is indeed doubted by many, and with good reason. The almost unlimited dynamic force of gunpowder, when well employed, will always exceed the statical powers of cohesion in a mass of iron; and the narrow limits of weight that must characterize a floating and moveable structure, confine us in the amount of molecular power we can use as a defence against the penetrative impulse of a heavy and quickly-moving projectile. However that may be, the great attention given of late years to the production of a material for resisting the tremendous force stored up in gunpowder—whether directly exerted as in the chamber of a gun, or indirectly as through a projectile—will greatly advance the peaceful art of the civil engineer.

Up to the present time, the rolling mills of the Atlas Works, Sheffield, seem to have produced the largest armour plates, as was well witnessed in the iron slab weighing more than 20 tons, being 19 ft. long, 3 ft. 9 in. broad, and 12 in. in thickness, lately rolled out in the presence of the Lords of the Admiralty on the 9th of April last. A very glowing and flourishing account of the operation appeared in the *Times*, and none of the natural doubts engineers might have felt were expressed as to the homogeneous character of the product. This plate, though larger, was of the same description as the famous armour plate from the Atlas Works in the late Exhibition, 22 ft. long and 4 ft. wide, and which was manufactured in the following manner:—The puddled bars were rolled into plates 1 in. thick, 12 in. broad, and 30 in. long, and five or six of these were then made into a pile and then rolled into the shape of a plate, 4 ft. long by 4 ft. broad. Five or six of these were again taken to form a plate 8 ft. long, 4½ ft. broad, and 2½ in. thick, the whole weighing about a ton and a-half. Four of these plates, with their edges trued up, are laid one upon the other in the furnace, and the whole is then rolled out in a mill with a backward-and-forward motion.

Rolled plates are, of course, cheaper to make than forged plates; but it is very questionable whether the joints between the plates are properly welded. The lines at the joints can be seen very distinctly at the edges of the plate. It is impossible for the men to brush away the scale that naturally forms itself on the inside surfaces, while the plates are lying in the furnace. As was well observed by Mr. Nasmyth, in allusion to the vitreous oxide of iron:—"So long as any portion of this adhesive viscid substance is permitted to exist and interpose itself between the surfaces we desire to unite by welding, no sound or trustworthy junction can take place; and where it has made a lodgment, no after-heating or hammering, be it ever so severe, will cause its thorough expulsion." As in a rolled plate, the fibres lie in the direction of the length only, these rolled armour plates will be very tough and strong in this direction. Across the fibres, however, these plates will be very weak. The piles of Mr. Brown's plates are said to be made up out of Swedish iron. According to Mr. Fairbairn, this is not the best iron for armour plates:—"It is not the iron which opposes the greatest resistance to a tensile strain, or to compression, that is most effective to resist impact. The presence of a small proportion of carbon causes brittleness; and toughness, combined with tenacity, are the qualities required."

The Thames Ironworks Company manufacture armour plates entirely forged under the steam-hammer. Faggots are built up out of one to one and a-half hundredweight of scrap iron, and three or four of these faggots are welded into a flat piece by means of a few blows from the hammer. The forging is completed by again bringing the flat piece to a welding heat, and then giving it a taper or bevel under the hammer. The whole armour plate is then gradually brought together, from similar separate wedge-like pieces, by welding the tapered sides together. The last operation consists in the plates being forged, at a moderate heat, to the required thickness, by means of 10 to 20-ton steam-hammers, with a fall of from 8 ft. to 12 ft. Hammers of from 2½ to 5 tons are powerful enough for the previous operations.

At Codnor-park Works, in Derbyshire, armour plates are made by a combined process of both forging and rolling. Two rolled plates are laid one above another, and are welded under the hammer to the required dimensions. This process appears very practical, and likely to make a good job; but it involves the drawback of a large surface of weld, and the consequent uncertainty of getting a good joint, more especially in the centre of the plates.

Up to the present, the process employed by Mr. Brown, of Sheffield, appears to be the most successful, and to have produced the largest plates. Size is of importance, as the joints in an armour-plated ship are like the chinks in the armour of an ancient knight. These rolled plates are probably of a more homogeneous character, at least in the direction of their length, than those produced by faggotting up a number of wedges, to be afterwards forged together under the hammer. The pressure of the rolls is unattended with impact, and is uniformly applied to every part of the plate in succession. In each successive passage through the diminishing apertures between the rolls, the pressure increases in an inverse ratio to the size of cross section of the plate. That the obscure phenomenon of crystallization is sometimes induced in forgings while under the hammer, is undoubted, although an explanation of the fact may not be readily forthcoming. Mr. Clay, of the Mersey Forge, Liverpool, who has certainly produced some of the largest and finest forgings that were ever turned out, appears to hold a contrary opinion to the above. He writes:—"A great deal has been said and written with reference to a supposed deterioration, or, as it has been called, crystallization of iron when heated into large masses, from long-continued and frequent heatings; it has also been asserted that the iron while lying in the furnace, is continually attracting carbon from the grate, until, in the course of time, it becomes carburetted, that is, re-converted into pig-iron." For a large forging, parts of which are cold, the vibrations communicated by the hammer are said by some to be the main cause of the crystallization of iron. In order to test the truth of the assertion that iron was deteriorated by the causes he had cited, Mr. Clay took "a small knob or corner . . . . from a large forging which had been overheated or burnt; it broke off with a *large flaky appearance*, very similar to some descriptions of lead ore. This was pronounced to be very similar in its nature to cast iron, and in the so-called crystallized state. Proceeding to the smith's department, the iron was heated in the fire, and drawn down to about three times its original length. It worked well under the hammer, and when broken again in the usual way, was as beautifully fibrous as the iron from which it was originally made." It is surprising that such a practical metallurgist as Mr. Clay should have forgotten the fact that the pieces of iron forming the faggot are almost always *separately stronger* than when worked up into a large forging. If, instead of taking a small piece off his large mass, and *again* working it up, he had cut away a piece of such a size that it could at once have been tested for itself, the result would have been very different. This was actually done in 1843 by a Committee of the Franklin Institute. They found that original bars from a faggot, the strength of which was represented by 46, had their tenacity diminished to 38 in the forging, while it was recovered by the piece cut out being again worked up. It may be remarked that the crystallization of iron is also furthered by its being in a highly heated state.

The welds are, however, the weakest parts in these massive forgings. There is little other security against the presence of a false weld than that afforded by the presumed skill of the workman.

It is evidently a nautical question as to the limit of weight of the iron sides of our seagoing ships; but it is a manufacturing question as to the power of resistance that can be imparted to a plate of given thickness. As Mr. Grantham observes, in his work on "Iron Ship Building," in reference to ordinary ships' plates:—"The angle and the rivet iron are subjected in using them to the action of the fire and the hammer, and if they are of inferior quality will show it; but the *plates* are not much tried in working, and their quality escapes observation."

TRIAL TRIP OF THE LONDON AND MEDITERRANEAN STEAM NAVIGATION COMPANY'S STEAM SHIP "ITALIA."

We feel much pleasure in placing the following particulars of this vessel and her engines before our readers, because we are fully impressed with the value of any practical results which can tend to dispel the crowd of prejudice which proves such a powerful obstacle to the introduction of a lighter class of marine machinery. None of the arrangements may, perhaps, be very novel. Surface condensation is not new, neither is expansion nor superheating; valve gearing presents every possible variety of arrangement; many cylinders have been used ere now to drive one crank shaft; but the successful combination of these different elements, in a manner which will bear the trial of practical experience, is novel, and Messrs. Maudslay and Field deserve high praise not only for the success which has attended their exertions, but for the enterprise which has led them, without seeking after novelties merely because they were such, to adopt every invention which their experience led them to regard as likely to conduce to the securing of a good result.

We believe that Messrs. Maudslay usher in improvements which will lead to the regeneration of the marine engine; and we trust that ere long the machinery of a steam ship and the fuel necessary to supply its vitality, will cease to be a burden absorbing all her energies in their mere conveyance. The success of the "Italia," like that of the "Octavia" with nearly similar engines, by the same firm, affords proof convincing enough, that economy is as easily attained by proper arrangements at sea as on land.

We may here remark that the "Italia" is not a new ship, and has been previously fitted with engines of about 110 nominal horse power, by Messrs. Rowan. The speed attained not being considered satisfactory, these have been replaced by the present engines.

The trial trip took place on the 19th inst., when the ship left her moorings off Gravesend, at about half-past eleven o'clock in the forenoon, and ran down to the measured mile at the Maplin sands. Although this was but the third time the engines have been under steam, they worked perfectly satisfactorily, without trouble from heating or any other cause. Four runs were accomplished, the average results of which we give below. On their conclusion, the vessel returned to her former berth.

	ft.	in.
The length of the "Italia" between perpendiculars is	210	0
Breadth, extreme	28	0
Depth of hold	16	6
Builder's tonnage	800 tons.	

Her engines are of 120 horses' nominal power, and have three cylinders, each 40 in. diameter, with a stroke of 2 ft. 6 in. working on to a 3-throw crank shaft, with the cranks set at 120 deg. to each other. The cylinders are jacketted round their circumference and at their ends, and are intended to work with steam of a pressure of 25 lb. to the square in. The collective area of the pistons is about one-half greater than in ordinary engines of the same power, it being intended to realize four times the nominal power, with the steam cut off at one-fifth of the stroke. The steam is shut off entirely by the slide valve, without the use of the ordinary expansion valve. The slides are specially adapted for this purpose, being double-ported, so far as the eduction passages are concerned, but having three steam openings, in order to give the requisite area for admission. They are worked by a shaft, with suitable cranks, running across in front of the valve chests. This shaft is driven from the main crank shaft of the engines by a system of wheel work, the two intermediate wheels of which are mounted in a moveable frame, which may be raised or lowered at pleasure, the effect of which is to vary the position of the cranks on the secondary shaft in relation to the position of the engine cranks. By this means, the steam may be shut off at any part between one-fourth and one-seventh of the stroke, and by the same means, the slide cranks may be shifted into the proper position for reversing the engines. There are two surface condensers, which are placed, together with their air-pumps, on the opposite side of the vessel to the cylinders, and facing the two outer ones. The space between the condensers, over the cross-heads and piston rods, is occupied by the engine platform. By this arrangement, all the working parts are brought well in view, and are easily reached by the engineer on the platform. The condensers are a modification of Hall's, in which the condensing water surrounds the exterior of the tubes, while the steam is condensed within them. In this case, the tubes are placed in a position inclined from the horizontal line, with covers forming chambers at each end; the exhaust pipe from the cylinder is brought into the chamber at the highest end of the tubes, and the condensed water is delivered into that at the lower end, from which it is conveyed to the air-pump. This arrangement leaves both ends of the tubes conveniently exposed when the covers are removed, while at the same time a space is left below the tubes for any mud that may be carried into the condensers to settle, and from which it can be easily removed. The water is driven through the condensing tanks by a plunger pump, fitted with *lignum vitæ* packing and india-rubber foot and delivery valves. This pump is placed opposite the middle cylinder, and worked by a rod direct from its piston. The condensed steam is pumped by the air-pumps into an open cistern, from which it is forced by the ordinary feed pumps into the boilers.

In the uptake of the single four-furnaced boiler is fitted a superheating apparatus, as patented by Mr. Field, which consists of a series of flattened tubes, through which the steam passes on its way to the engines. These tubes are placed in rows one above the other, so as to offer the least possible obstruction to the heated gases passing to the chimney; and the apparatus is so constructed that any of the tubes may be readily taken out and renewed should they at any time become defective, without interfering with the others, while at the same time their exterior surfaces can be easily cleaned from any soot that may be deposited upon them. The screw propeller is three-bladed, and 17 ft. 6 in. pitch. At the trial on the 19th June the draft of the water was 9 ft. 6 in. forward, and 11 ft. 9 in. aft, equal to a mean of 10 ft. 7½ in., with an area of immersed section of 235 square feet. The pressure of the steam was 22 lb., and vacuum 27 in., the engines making 73 revolutions per minute, steam cut off at 1-6th of the stroke. The mean speed of four runs at the measured mile was 11·387 knots, the temperature of the superheated steam being 330 deg., and the indicator showed a mean of 617-horse power. The engines were under the able superintendence of Mr. Warner. So admirable are the arrangements for clothing the cylinders, steam pipes, &c., that the temperature in the engine-room scarcely exceeded that on deck, or under 70 deg. All the arrangements were skilfully carried out under the direction of Herbert Maudslay and Joshua Field., Esqs. The consumption of fuel was, making every allowance, about 2·5 lb. of Welsh coal per indicated horse per hour—a result which speaks for itself.

ON THE FORMS OF THE STRATIFIED ALPS OF SAVOY.

At the weekly evening meeting of the Royal Institution of Great Britain, Friday, June 5, 1863, Sir Henry Holland, Bart., M.D., D.C.L., F.R.S., Vice-President, in the chair, a Paper was read "On the Forms of the Stratified Alps of Savoy," by John Ruskin, Esq.

The purpose of the discourse was to trace some of the influences which have produced the present external forms of the stratified mountains of Savoy, and the probable extent and results of the future operation of such influences.

The subject was arranged under three heads:—

I. The Materials of the Savoy Alps.
II. The Mode of their Formation.
III. The Mode of their subsequent Sculpture.

I. *Their Materials.*—The investigation was limited to those Alps which consist, in whole or in part, either of Jura limestone, of Neocomian beds, or of the Hippurite limestone, and include no important masses of other formations. All these rocks are marine deposits; and the first question to be considered, with respect to the development of mountains out of them, is the kind of change they must undergo in being dried. Whether prolonged through vast periods of time, or hastened by heat and pressure, the drying and solidification of such rocks involved their contraction, and usually, in consequence, their being traversed throughout by minute fissures. Under certain conditions of pressure, these fissures take the aspect of slaty cleavage; under others, they become irregular cracks, dividing all the substance of the stone. If these are not filled, the rock would become a mere heap of debris, and be incapable of establishing itself in any bold form. This is provided against by a metamorphic action, which either arranges the particles of the rock, throughout, in new and more crystalline conditions, or else causes some of them to separate from the rest, to traverse the body of the rock, and arrange themselves in its fissures, thus forming a cement, usually of finer and purer substance than the rest of the stone. In either case, the action tends continually to the purification and segregation of the elements of the stone. The energy of such action depends on accidental circumstances. First, on the attractions of the component elements among themselves; secondly, on every change of external temperature and relation: so that mountains are at different periods in different stages of health (so to call it) or disease. We have mountains of a languid temperament, mountains with checked circulations, mountains in nervous fevers, mountains in atrophy and decline.

This change in the structure of existing rocks is traceable through continuous gradations, so that a black mud or calcareous slime is imperceptibly modified into a magnificently hard and crystalline substance, enclosing nests of beryl, topaz, and sapphire, and veined with gold. But it cannot be determined how far, or in what localities, these changes are yet arrested; in the plurality of instances they are evidently yet in progress. It appears rational to suppose that, as each rock approaches to its perfect type, the change becomes slower; its perfection being continually neared, but never reached; its change being liable also to interruption or reversal by new geological phenomena. In the process of this change, rocks expand or contract; and, in portions, their multitudinous fissures give them a ductility or viscosity like that of glacier-ice on a larger scale: so that many formations are best to be conceived as glaciers, or frozen fields of crag, whose depth is to be measured in miles instead of fathoms; whose crevasses are filled with solvent flame, with vapour, with gelatinous flint, or with crystallizing elements of mingled natures; the whole mass changing its dimensions and flowing into new channels, though by graduations which cannot be measured, and in periods of time of which human life forms no appreciable unit.

II. *Formation.*—Mountains are to be arranged, with respect to their structure, under two great classes—those which are cut out of the beds of which they are composed, and those which are formed by the convolution or contortion of the beds themselves. The Savoy mountains are chiefly of this latter class. When stratified formations are contorted, it is usually either by pressure from below, which raises one part of the formation above the rest; or by lateral pressure, which reduces the whole formation into a series of waves. The ascending pressure may be limited in its sphere of operation; the lateral one necessarily affects extensive tracts of country, and the eminences it produces vanish only by degrees, like the waves left in the wake of a ship. The Savoy mountains have undergone both these kinds of violence in very complex modes and at different periods, so that it becomes almost impossible to trace separately and completely the operation of any given force at a given point.

The speaker's intention was to have analyzed, as far as possible, the action of the forming forces in one wave of simple elevation, the Mont Salève; and in another of lateral compression, the Mont Brezon; but the investigation of the Mont Salève had presented unexpected difficulty. Its façade had been always considered to be formed by vertical beds, raised into that position during the tertiary periods; the speaker's investigations had, on the contrary, led him to conclude that the appearance of vertical beds as owing to a peculiarly sharp distinct cleavage, at right angles with the beds, but nearly parallel to their strike, elsewhere similarly manifested in the Jurassic series of Savoy, and showing itself on the fronts of most of the precipices formed of that rock. The attention of geologists was invited to the determination of this question.

The compressed wave of the Brezon, more complex in arrangement, was more clearly defined. A section of it was given, showing the reverse position of the Hippurite limestone in the summit and lower precipices. This limestone wave was shown to be one of a great series, running parallel with the Alps, and constituting an undulatory district, chiefly composed of chalk beds, separated from the higher limestone district of the Jura and lias by a long trench or moat filled with members of the tertiary series—chiefly nummulite limestone and flysch. This trench might be followed from Faverges, at the head of the lake of Annecy, across Savoy. It separated Mont Vergi from the Mont Dorons, and the Dent d'Oche from the Dent du Midi; then entered Switzerland, separating the Moleson from the Diablerets; passed on through the districts of Thun and Brientz, and, dividing itself into two, caused the zigzagged form of the lake of Lucerne. The principal branch then passed between the high Sentis and the Glarnisch, and broke into confusion in the Tyrol. On the north side of this trench the chalk beds were often vertical, or cast into repeated folds, of which the escarpments were mostly turned away from the Alps; but on the south side of the trench, the Jurassic, Triassic, and Carboniferous beds, though much distorted, showed a prevailing tendency to lean towards the Alps, and turn their escarpments to the central chain.

Both these systems of mountains are intersected by transverse valleys, owing their origin, in the first instance, to a series of transverse curvilinear fractures, which affect the forms even of every minor edge, and produce its principal ravines and boldest rocks, even where no distinctly excavated valleys exist. Thus, the Mont Vergi and Aiguilles of Salouvre are only fragmentary remains of a range of horizontal beds, once continuous, but broken by this transverse system of curvilinear cleavage, and worn or weathered into separate summits.

The means of this ultimate sculpture or weathering were lastly to be considered.

III. *Sculpture.*—The final reductions of mountain form are owing either to disintegration, or to the action of water, in the condition of rain, rivers, or ice; aided by frost and other circumstances of temperature and atmosphere.

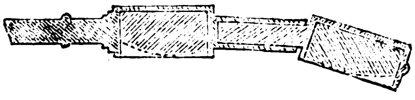
All important existing forms are owing to disintegration, or the action of water. That of ice had been curiously overrated. As an instrument of sculpture, ice is much less powerful than water; the apparently energetic effects of it being merely the exponents of disintegration. A glacier did not produce its moraine, but sustained and exposed the fragments which fell on its surface, pulverizing these by keeping them in motion, but producing very unimportant effects on the rock below; the roundings and striation produced by ice were superficial; while a torrent penetrated into every angle and cranny, undermining and wearing continually, and carrying stones, at the lowest estimate, six hundred thousand times as fast as the glacier. Had the quantity of rain which has fallen on Mont Blanc in the form of snow (and descended in the ravines as ice), fallen as rain, and descended in torrents, the ravines would have been much deeper than they are now, and the glacier may so far be considered as exercising a protective influence. But its power of carriage is unlimited, and when masses of earth or rock are once loosened, the glacier carries them away, and exposes fresh surfaces. Generally, the work of water and ice is in mountain surgery like that of lancet and sponge—one for incision, the other for ablution. No excavation by ice was possible on a large scale, any more than by a stream of honey; and its various actions, with their limitations, were only to be understood by keeping always clearly in view the great law of its motion as a viscous substance, determined by Professor James Forbes.

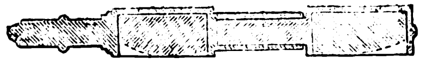
The existing forms of the Alps are, therefore, traceable chiefly to denudation as they rose from the sea, followed by more or less violent aqueous action, partly arrested during the glacial periods, while the produced diluvium was carried away into the valley of the Rhine or into the North Sea. One very important result of denudation had not yet been sufficiently regarded—namely, that when portions of a thick bed (as the Rudisten-kalk) had been entirely removed, the weight of the remaining masses, pressing unequally on the inferior beds, would, when these were soft (as the Neocomian marls), press them up into arched conditions, like those of the floors of coal-mines in what the miners called "creeps." Many anomalous positions of the beds of Spatangen-kalk, in the district of the Lake of Annecy were, in all probability, owing to this cause; they might be studied advantageously in the sloping base of the great Rochers de Lanfon, which, disintegrating in curved, nearly vertical flakes, each a thousand feet in height, were nevertheless a mere outlying remnant of the great horizontal formation of the Parmelan, and formed, like it, of very thin horizontal beds of Rudisten-kalk, imposed on shaly masses of Neocomian, modified by their pressure. More complex forms of harder rock were wrought by the streams and rains into fantastic outlines; and the transverse gorges were cut deep where they had been first traced by fault or distortion. The analysis of this aqueous action would alone require a series of discourses; but the sum of the facts was that the best and most interesting portions of the mountains were just those which were finally left, the centres and joints, as it were, of the Alpine anatomy. Immeasurable periods of time would be required to wear these away; and to all appearances, during the process of their destruction, others were rising to take their place, and forms of perhaps far more nobly-organized mountain would witness the collateral progress of humanity.

BECK'S READING-LENSES.

Heretofore lenses have frequently been made of such a size that a person can see through them with both eyes simultaneously; but these are massive and expensive. Spectacles have also been made with lenses of considerable magnifying power; but if such spectacles are used as magnifiers by persons having natural eyesight to enable them to see objects placed at, say, four or five inches only from the eye, a considerable strain on the sight is perceptible.

According to an invention, just patented by Mr. R. Beck, of Upper Hollloway, he makes a binocular reading-glass or magnifier by dividing a lens into two equal parts, and mounting the two parts at a short distance apart in a frame but without in other respects altering the relative, positions of the parts, except that with the highest powers he prefers to incline each part outwards to some extent, so that the axis of each half-lens may be inclined in the direction of the object, as hown in the engravings.





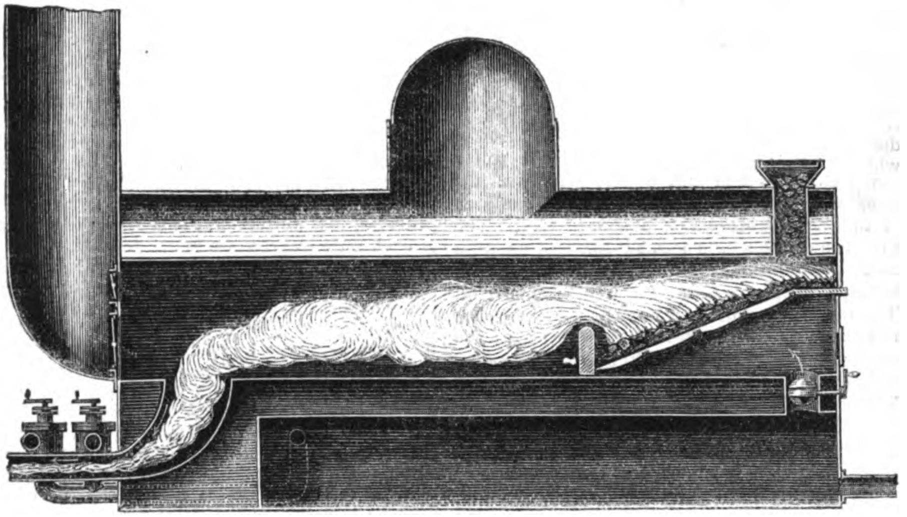
Reading-glasses thus constructed may be used without any strain to the eye being apparent; they are also much more readily constructed and produce less distortion than a single lens of sufficient size to be used simultaneously with both eyes. These advantages become very apparent when the lens is of short focal length, in which case the constructing a single lens of sufficient size becomes practically impossible.

KOPISCH'S PROPELLING, STEERING, AND VENTILATING APPARATUS.

A patent has been obtained by Mr. C. G. Kopisch, of Bishopgate-street, for an apparatus for effecting the propulsion of steam ships or vessels by the injection into the water on which such vessels float of columns or streams of heated air.

The arrangement of the apparatus employed for heating the air may be described as a furnace contained within, and extending from end to end of, an elongated horizontal steam boiler, below which is situated an air reservoir This reservoir is supplied with air by a pumping engine, which shall draw the air from the hold of the ship, with which the various cabins are brought into communication by the air pipes for the purpose of effecting their ventilation. This pumping engine is to be worked by a steam engine supplied with steam from the steam boiler. The air reservoir is brought into connection with the ash-pit of the furnace by pipes, which supply air under pressure to the fire-place. The furnace is connected at its rear end with a chimney by two flues of different diameters, as shown in the above engravings, both of which are capable of being easily closed. From the furnace also lead off air trunks, the outer ends of which open into and below the surface of the water, for the purpose of directing columns of air rearwards, and thereby propelling the ship forwards. The fire-grate being charged with coal from a hopper, and closed to exclude the passage of air, the fire-door is opened and also the larger of the flues leading to the chimney. By this means a draft is obtained to permit of the kindling of the fire and the getting up of steam in the boiler. This being effected and the pumping engine set in action, the flue and fire-door are closed, and air is admitted from the air reservoir to the furnace, the circulation being now maintained by opening the smaller flue leading to the chimney. When it is desired to start the vessel, this flue is also closed, and the heated air and gases of combustion are directed into the water through the propelling air trunks. Other air trunks are also arranged and brought into communication with the main air trunk leading from the furnace, that hot air may be discharged at either side of the ship for the purpose of steering it, and a second set of propelleng air trunks are provided for directing the air forwards, and thus imparting, when desired, a backwsrd motion to the ship.

KOPISCH'S PROPELLING, STEERING, AND VENTILATING APPARATUS.



BROOMAN'S BOILER-TUBES.

FIG. 1.

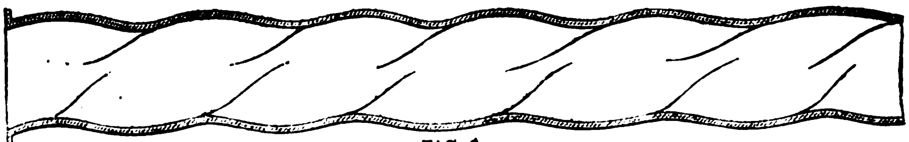
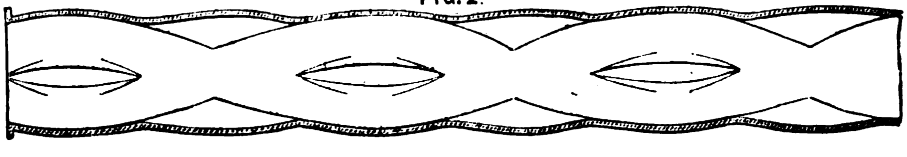


FIG. 2.



BROOMAN'S BOILER-TUBES.

Mr. R. A. Brooman, of Fleet-street, has just patented, on behalf of Messsrs. Delafond and Corradi, of Marseilles, an improvement in tubes for boilers, condensers, and superheaters. The engravings illustrate two shapes of tubes.

The invention consists in the employment in boilers, condensers, and superheaters of helical instead of straight tubes. The tubes may have one or more turns in their length. The invention also consists in obtaining similar effects in straight tubes to those resulting from the employment of helical tubes, by fixing therein or thereon screw or twisted vanes.

Fig. 1 shows a tube having a single spiral, and fig. 2 a tube with a double spiral.

In boilers, however, in which the products of combustion pass inside the tubes, such vanes will not be applicable, because not being in contact with water they would be rapidly consumed; they apply, however, in condensers and superheaters, and may also be used in boilers with vertical tubes, round the outside of which gases and products of combustion pass.

PROSPECTS OF THE IRON TRADE.

During the last nine months a substantial improvement has taken place in the state of the iron trade of South Wales, and the result is that the works are better employed, and there is a very considerable increase in the number of furnaces in blast. It cannot be said that the trade is in anything like a prosperous state; but the depression of the last four years seems to be gradually disappearing, and a more promising and hopeful feeling has taken its place. The best evidence of this fact is in the actual extension of works that were kept going during the depressed times, and the number of old works that have been, or are about to be, brought into life again. Among the extensions and improvements may be mentioned the lighting of an additional furnace at Ebbw Vale, Abersychan, and Llwydcoed respectively, the erection of a new mill at the Plymouth works, and also extensions at Sirhowy, Aberdare, &c. The old works revived are Varteg, where two furnaces have been put in blast; Golynos, where two others are about to be lighted; and the Cwmbran forge will recommence working without delay. The Venallt furnaces are also likely to be started again, and if the present improving tendency of the trade should continue, there are hopes that something will be done at Hirwain and Treforest. An extensive new establishment—the Marshfield Ironworks, near Llanelly—has lately been started, for the special object of producing armour-plates. These facts, and others which might be mentioned, clearly show that the iron trade of the district is gradually emerging from the depression which has characterized it for so long a time.

The make of pig iron in South Staffordshire is to be reduced by the blowing out of blast furnaces. Several have been blown out during the last week, and it is expected that some other makers of pig iron will follow the example. Mr. Benjamin Gibbons blew out one at Millfields on Saturday, and contemplates blowing out another. Messrs. Turley, of Coseley, also blew one out on Monday; and Messrs. Colebourne, of Tipton, have done the same. The Parkfield Company and Messrs. Cresswell have also determined to blow out a furnace each. This, as we have previously stated, is, in the present state of the trade, the only course open to prevent the price of pig iron falling below remunerative rates.

The iron trade of France is very unsettled owing to the state of affairs in Russia and Prussia. Some orders for pig iron were received at St. Dizier last week to be executed within a limited period. Buyers in general impose this condition when they are aware that the ironmasters are not overburdened with orders. The stock in hand at present is not large, as the orders have been latterly so limited that ironmasters have manufactured barely sufficient to satisfy the demand. Ironmasters are asking for the present from 225f. to 230f. A letter from Longwy, in the Moselle, says, that although the demand for iron is good, and that the ironmasters have orders on hand, it is not possible to make the slightest increase to existing prices. The manufacturers of rails are working in anticipation of the orders they expect to receive from the railway companies engaged in constructing new lines. These companies have not yet concluded many contracts with the ironmasters. Railway directors are not yet decided as to what price they ought to offer, and ironmasters are uncertain as to the price they ought to ask. It is expected that when one railway company shall have concluded a large contract by which the price of rails shall be fixed, all the others will follow.

PURIFIED COKE FOR IRON SMELTING.

M. E. Kopp, a German chemist, describes the following mode of purifying coke, a subject of considerable interest both to coal mine proprietors, and ironmasters.

After the conversion of coal into coke in the usual way, it is taken red-hot from the furnace. In well-constructed coke-furnaces this is effected mechanically; the furnace is open at each extremity, and a very thick, shield-shape plate of cast iron, adjusted to a strong-toothed rod of iron, which is propelled with great force by gears, gradually pushes before it, and finally expels from the furnace, in a single block, the whole of the prepared coke. The incandescent coke is generally extinguished by throwing a large quantity of water over it. This water it is proposed to acidulate with hydrochloric acid.

The incandescent coke may contain protosulphide of iron, proceeding from the pyrites, which at red-heat have lost half their sulphur, sulphide of calcium proceeding from the reduction of sulphate of lime, phosphates, silicates, &c. By contact with the diluted hydrochloric acid, the sulphides of iron and calcium are transformed into chlorides of iron and calcium, with disengagement of sulphuretted hydrogen, which is carried away by the water vapours, escaping abundantly when the coke is extinguished. The phosphates are converted into soluble biphosphates, and even the silicates may be attacked; the bases dissolve as chlorides, a portion of the silica at the same time becoming soluble, which happens when a silicate is digested, hot, in a very diluted acid. Were the coke merely sprinkled with hydrochloric water, and allowed to dry immediately from the heat retained in it, even when the burning had ceased, the chlorides, biphosphates, and silica would remain; but certainly the sulphuretted hydrogen, and with it nearly all the the sulphur, would have been eliminated. But, on the contrary, if the coke were impregnated with acid solution, and were then washed with water, a large portion of the impurities specified would be expelled by the washing. The washed coke can then be dried, either in the air or by the unutilized heat of the coal kilns. To impart to it still more the qualities of charcoal, it may be sprinkled with a weak solution, or powdered over with dry carbonate of soda, as free as possible from sulphate.

The carbonate of soda, prepared by means of cryolite (double fluoride of aluminium and sodium), naturally containing no trace of sulphate, answers best for this purpose.

In most instances finely-powdered cryolite may be used with advantage, and ⅓ to ½ per cent. added to the coke. Cryolite supplies economically the alkali which the coke lacks; and though the soda exists in this mineral in the state of fluoride, there seems no doubt as to its beneficial influence.

We have had occasion to make several trials in fusing cast iron and steel with coke purified by weak hydrochloric acid, with the addition of a little carbonate of soda, and the results were decidedly favourable, as compared with those obtained with ordinary unprepared coke.

Finally, we think that a series of experiments should be undertaken, to ascertain what effect cryolite used in blast furnaces would have on the yield and on the quality of cast iron, and in puddling furnaces on the properties of puddled steel. Cryolite is found in very large masses in Greenland, and the price will decrease as the applications of it become more numerous.

SIR GEORGE GREY AND ROAD LOCOMOTIVES.

A short time since a case came before the Wiltshire county magistrates at Salisbury, when a Mr. Rowland, the owner of a locomotive engine, was summoned for allowing it to remain on the highway in the parish of Britford. The summons was issued under the Highway Act, at the instance of Viscount Folkestone, who was very desirous that the question as to the right of running engines on the highways should be tried. It was argued, on the part of the defendant, that the Act of Parliament passed in 1861 repealed the clause in reference to locomotives in the Highway Act, and the case was adjourned in order that the opinion of the Home Secretary might be obtained. Lord Folkestone did not write to Sir George Grey, but applied to Baron Wilde, who gave it as his opinion that the use of locomotives along a high road was legal. If they were driven too fast, so as to cause a nuisance, then the owner could be indicted, but there was no penalty recoverable under the Highway Act. During the past week the Wiltshire magistrates have received the following letter from the Home-office, which decision is of considerable importance to engineers:—"Sir,—I am directed by Secretary Sir George Grey to acknowledge the receipt of your letter of the 9th inst., and to inform you that, in compliance with the wishes of the justices of the division of Salisbury and Amesbury, Sir George Grey has this day issued an order, which will appear in the *Gazette* of next Tuesday, prohibiting the use of any kind of locomotive whatever propelled by steam, or any other than animal power, on the highways within the several parishes comprised in the above-named division, excepting between the hours of 9 o'clock at night and 7 in the morning.—I have the honour to be, &c.—H. A. Bruce."

INFLUENCE OF FROST ON IRON.

The following extract from Kirkaldy's work on iron and steel goes far to prove that the effect of cold on the strength of iron is less injurious than is generally imagined:—Frost being considered to act injuriously on the strength of iron, some experiments were made during the severe weather in Dec., 1860, to ascertain its effects. A bar of Glasgow B best, ¾ in. diameter, was converted into ten bolts, in the ordinary way, six were exposed all night to intense frost, and tested in the morning with the thermometer at 23 deg. Fahr. The other four were kept in a warm place, and carefully protected during testing. Three were tested with gradual, and seven with sudden strains; it was found that when the strain was gradually applied there was very little difference between the specimen tested in the ordinary condition and the two that were frozen; the former bore 55,717, the latter 54,385; difference, 1,332 lb., or 2·3 per cent. less. The difference under sudden strains is somewhat greater, viz., 3·6 per cent. less when frozen. The load just sufficient to cause rupture was in the one case somewhere between 50,535 and 49,948; in the other, between 49,060 and 48,100; the mean in the one instance being 50,391, in the other 48,584; difference, 1,807 lb., or 3·6 per cent. The writer regrets that other duties prevented him from carrying out his intention of repeating these experiments with bars of various qualities. It will be noticed that the bar tested happened to be of superior quality: had it been of a coarser description, the difference when frozen might have been much greater. The frozen bolts were coated with a thin layer of ice, for the purpose of better observing the effects produced. In specimen, with strain slowly applied, the ice gradually became opaque and white, and just before breaking it resembled hoar frost. In another specimen, under sudden strain the ice remained transparent, and the instantaneous stretching of the specimen, was most beautifully exhibited by the ice cracking and forming a series of complete rings. In yet another, the strain was greater than in the last, and caused the rupture of the specimen; the heat thereby generated was apparent by the ice melting, and in the formation of vapour.

WORKING BEAM ENGINES.

It is not a little remarkable, in the history of the present struggle, that the beam engines in the naval service should have escaped material injury—that all steam engines, in fact, above and below the water line, have been but slightly damaged, considering their exposure. He would have been a rash man who had predicted at the beginning of the rebellion that steam machinery in our gunboats would have escaped, while the hulls of the ships themselves have been riddled by the fire from forts and batteries with which they have been engaged. Of course, when it has been necessary to blow up some of our vessels, the engines have been scattered, with the other fragments, to the four winds of the earth; but we have not yet upon record any instance where a beam engine particularly has been entirely crippled for any length of time, still less destroyed. When the wrought-iron strap of a working beam breaks, the skeleton is also fractured, the piston is forced out through the cylinder head, the front links are bent, the frame is thrown out of line, in short, there is dire confusion and utter wreck. It is a comparatively easy thing to predict what would occur in case a huge round shot struck a working beam; in fact, there is no question but that it would place the machine *hors de combat* instantly. Since, however, we have no data to refer to, no such incident having ever taken place, all inferences are gratuitous. It is noticeable that the steam machinery of our wooden vessels and iron-clads have performed well, and that no accidents of a general nature have taken place, showing them to be unreliable in time of need. Had any one of the "Monitors" or the "Ironsides" become unmanagable before Fort Sumter, they would, ere this, have been resting upon the bottom of the harbour, and the fact that they peformed well generally is creditable to the skill of our engine-builders. The gunboats maintain their stations on the blockading squadron and are not continually running home for repairs; and whether they attain as much speed as would be desirable or not, it is certain that thus far they have done the nation good service in a time of need.—*Scientific American.*

The new saloon steamer "Iona" is reported to have run the lights in 45½ minutes, being the greatest rate of speed ever attained on the Clyde.

KLEIN'S TURNING LATHE.

FIG. 1.

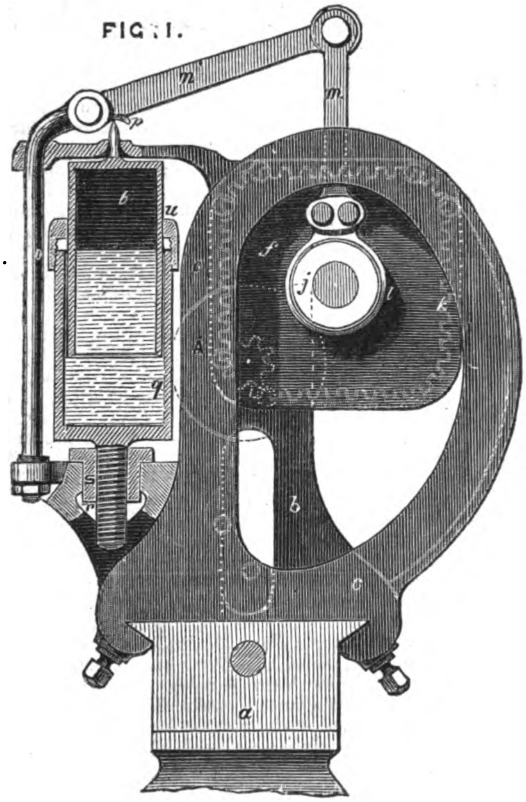
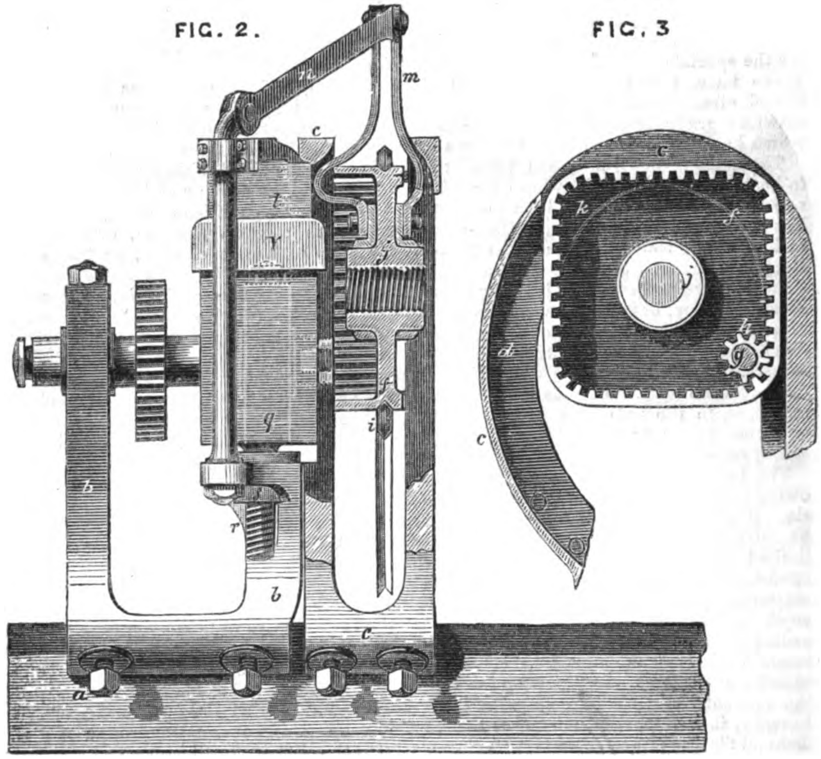


FIG. 2. FIG. 3



KLEIN'S TURNING-LATHE.

A patent has just been obtained by Mr. P. H. Klein, of Paris, for an invention for improvements in machinery for turning or shaping. The invention consists in the employment of machinery in combination with an ordinary turning-lathe, for shaping metals and other substances, square or polygonal, instead of round or oval as hitherto. The invention will be best understood by reference to the accompanying engravings—fig. 1 of which is an elevation, partly in section, of the end of a lathe with the improved machinery applied thereto; fig. 2, a longitudinal elevation of the same; and fig. 3, a face view of the frame or carrier for carrying the article to be shaped, and of a guide in which it turns, as hereafter explained.

The bed *a* of the lathe, with its puppet *b*, carries a guide *c*, in the thickness of which is formed a groove *d*, in which a moveable frame or carrier *f* works. The guide *c* is free to slide on the bed *a*. The principal shaft *g* is threaded at its extremimity as in ordinary lathes, and carries a small pinion *h*, held by a screw-thread, and in gear with a toothed rack *k* on the interior of the frame *f*. The frame *f* thus bears against the guide *c*, and it carries small rollers *i*, *i* to facilitate its movement in the groove *d*. The rack *k* is rounded at the corners, so that it may always be in gear with the pinion *h* which drives it; it may be cast in a piece with the frame *f*, or it may be cast separately and fixed to it by screws. In the centre of the frame *f* is a socket *j*, threaded on the inside for receiving the article to be shaped. This socket is supported by a collar *l*, held by two arms *m*, *m*, united by hinge-joints to a lever *n* connected to a support *o* fixed to the frame of the guide *c*. The internal groove in the guide *c* is interrupted at A, to allow of the passage of the rollers *i*, *i* when the frame turns. The lever *n* rests upon a point *p*, projecting from the top of a suspension puppet, which is arranged as follows:—A vessel *q*, containing water or other liquid, carries at bottom a screwed rod *r*, which takes into a threaded nut *s* resting upon the frame of the puppet. An inverted vessel *t* descends into the liquid in the vessel *q* to form a hermetic joint, aided by a socket *u*, which is screwed on the upper part of the vessel *q*, and makes a stuffing box. The lever *n* presses upon the point *p*, and causes the vessel *t* to descend in the liquid in the vessel *q*; the air held in the vessel *t* is thereby compressed in such a manner as to form a balance or equilibrium to the weight of the frame *f* and the object carried by it and under work. The pressure is regulated by raising or lowering the vessel *q* by means of the nut *s*.

The arrangement just described is applicable to chuck-lathes—that is to say, those lathes in which the article to be shaped is fixed on the nose of the lathe, no back centre being required. When it is desired to turn articles the length of which necessitates a back centre, a parallel lathe is employed with two similar puppets, one of which serves as a back centre to the other.

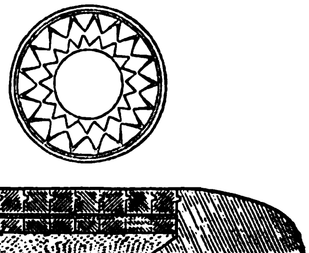
Articles of round shape may be turned by the arrangement before described by removing the pinion *h* and employing an ordinary turning tool. The frame *f* is maintained in a vertical plane during the working of the machine by the pinion and by the cheeks of the rack, as well as by the groove *d*, in such manner that, upon being caused to slide in the groove by means of the pinion *h*, which is fixed on the principal shaft, it presents the several faces of the article being shaped successively to the cutting or shaping tool.

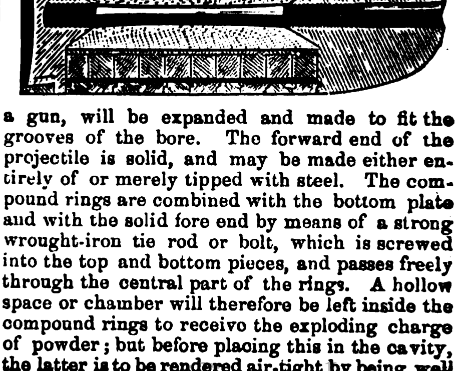
PALMER'S PROJECTILES.

An invention of improvements in hollow projectiles has recently been patented by Mr. F. Palmer, of the Strand. The object of the invention is, first, to construct a hollow projectile in such a manner that its flight shall be true and not erratic, and that, whatever the range may be, the projectile shall strike the object with the point or fore end foremost. This is effected by distributing the weight in such a manner that the fore end or forward half of the projectile, except bomb shells, which must be spherical, shall contain a large excess, say, about two-thirds, of the entire weight.

Another part of the invention consists in constructing the projectile of a series of single rings, or compound rings, composed of two, three, or more single rings, arranged and formed in such a manner, that on the projectile exploding the rings shall be subdivided into a large number of pieces of nearly equal dimensions, and of such a weight, that any piece, by its mere gravity or weight when falling from a height, will be sufficient to kill or seriously injure a man.

The compound rings are made of metal, and consist of a series of diamond or wedge-shaped pieces assembled together in an annular form, and so constructed that each set of rings will fit into one another so as to form a flat compound ring with an open centre. Any conveninent number of these compound rings may be piled one upon the other on an end plate, the outer end of which (if the projectile be intended for a rifled gun) may be provided with a washer of brass or soft metal, which, upon the projectile being fired from a gun, will be expanded and made to fit the grooves of the bore. The forward end of the projectile is solid, and may be made either entirely of or merely tipped with steel. The compound rings are combined with the bottom plate and with the solid fore end by means of a strong wrought-iron tie rod or bolt, which is screwed into the top and bottom pieces, and passes freely through the central part of the rings. A hollow space or chamber will therefore be left inside the compound rings to receive the exploding charge of powder; but before placing this in the cavity, the latter is to be rendered air-tight by being well





WHITAKER'S PULPING AND SLICING MACHINE.

FIG. 1.

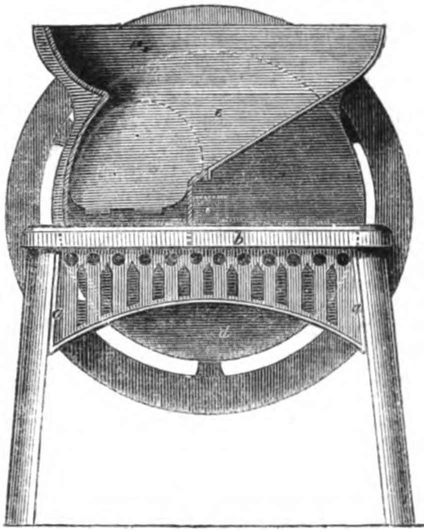


FIG. 2.

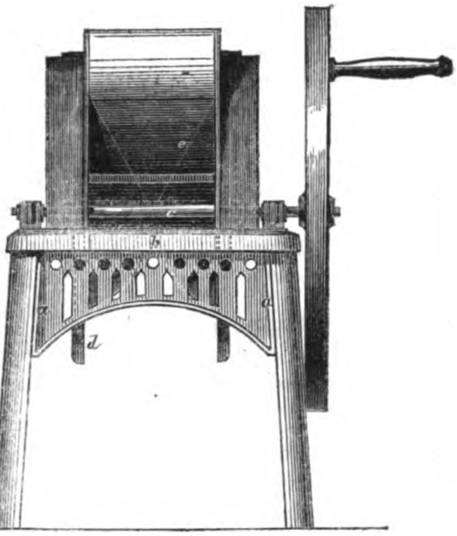


FIG. 3.

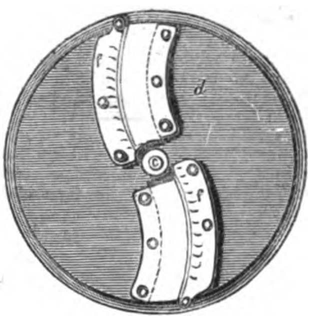
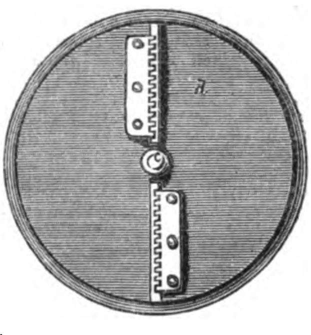


FIG. 4.



paid over with strong paint of white lead, zinc, or other suitable composition, which will close the interstices between the rings. Projectiles on this principle may either be made cylindrical or elongated with conical or pointed ends, or they may be made spherical like ordinary bomb shells. The engravings clearly show the invention.

The projectiles may be provided with a common fuze, which will be ignited by the propelling charge in the ordinary manner. A percussion fuze may also be employed to explode the internal charge when the projectile strikes any object; it is therefore of the greatest importance that the flight of the projectile should be accurate, and that it should not be liable to turn end over end in the air before it strikes the object.

By subdividing the compound rings into separate rings, each composed of a series of pieces of a wedge or diamond shape, or other suitable form, it will be understood that, upon the explosion of the internal charge taking place, the rings and discs will be split up or divided into a vast number of fragments, and will be thrown with such force that each fragment will be capable of killing or disabling a man.

WHITAKER'S PULPING AND SLICING MACHINE.

Heretofore the pulping, stripping, and slicing of roots for cattle food have been done in two or more machines. Mr. J. Whitaker, of Leigh, Lancaster, has patented an improved machine whereby the above operations can be effectually done in one apparatus. Fixed to the driving shaft at each side of the machine is a fly-wheel, one mounted with one or more knives for slicing, and the other with the knives or tools for pulping. The stripping knives or tools are fixed upon separate plates which when required are screwed to the slicing wheel, there being slots in the wheel to allow the tools to pass through the interior. The hinged guide or plate is placed in the centre of the hopper, and can be turned on either side so as to guide the roots to the pulpers on one of the wheels, or to the slicing knives or strippers on the other wheel, by which means the three operations of pulping, slicing, and stripping can be performed at different times in the same machine. The rims of the wheels turn in grooves formed by beads in the sides of the hopper in order to enable the knives or tools to be quite close to their work, and thereby slice, strip, or pulp the last piece, and the sides of the hopper are curved and sloped to allow the matters to be delivered from the machine with perfect ease.

a represents the framework of the machine; *b*, the bed or table; *c*, the driving shaft; *d*, the plain wheel to which the slicers, pulpers, and strippers are attached; and *e* the hinged guide or plate for leading the roots to the slicing or stripping knives on one side or to the pulping knives on the other side. The pulpers are on one wheel, and the knives for slicing on the other wheel; and when stripping is required to be performed, the plates *f*, fig. 3, with the strippers in them are fixed to the wheel; but when slicing is to be performed, the strippers are removed. Thus by fixing on the driving shaft two wheels mounted with the necessary cutters or tools and using the hinged guide to lead the roots to one side or the other, the several operations of pulping, stripping, and slicing edible roots can be performed in one machine.

FLAX-SCUTCHING MACHINES.

Now that so much attention is deservedly given to the cultivation of flax, it becomes of the highest importance to obtain an efficient scutching machine. At the late Agricultural Meeting at Lille, where large quantities of flax are cultivated, a gold medal was offered for the best scutching machine. We believe there were about forty competitors, and are gratified in stating the medal was awarded to the scutcher invented by Messrs. Rowan, of Belfast, and exhibited by Messrs. Le Conte, of Morlaix. In this machine the beaters are thrown out by centrifugal force, but by being loose in their bearings, they exert only sufficient power upon the flax to beat out and separate the loose and woody particles from the fibre without tearing or injuring it. Very little tow is produced. One advantage possessed by the machine is that its price puts it within reach of the small flax-growers.

THE MANUFACTURE OF COMPOSITE CANDLES AT CLICHY.

The manufacture of stearine* is essentially French—from the first works of MM. Chevreul and Gay-Lussac in 1824, and the industrial realisation of MM. de Milly and Motard in 1835, down to the recent idea of decorating the wax candle, and making it an ornament which completes the luxury of candelabra. The numerous inconveniences of the candle, its nauseous odour, its insufficient consistency, its smoky wick requiring snuffers, added to the high price of wax, stimulated the inventors in their researches. As in a great number of industrial operations, the spirit of fraud guided the wax-chandlers. They commenced by making tallow candles coated with a layer of wax; but the fraud was discovered quickly enough by the fœtid emanations arising therefrom. They mixed with the wax different kinds of flour—beans and horse-chesnuts. They also tried to fabricate tallow candles which appeared to be wax; but this did not give very satisfactory results. The wick was always smoking, the snuffers necessary, and the candle, disguised under divers names, continued to soil the hands, and to stain the clothes and furniture. It was reserved for MM. Chevreul and Gay-Lussac to discover, in 1825, the principles by the aid of which MM. de Milly and Motard, assisted by the researches of M. Cambaceres, should, in 1835, lay the foundation of an entire industry, one of the most flourishing of the present day—the fabrication of the stearine wax candles. The trials of experience had been fruitless; it was the methodical researches of chemistry which triumphed with *eclat*. They had a portion of tallow analyzed, which they found composed of three acids—stearic, margaric, and oleic, with a base termed glycerine, the first acid fusible at 60 deg., the second at 47 deg., and the third liquid at 0. They analyzed the three acids, and they discovered that they were formed of carbon and hydrogen, together with a certain quantity of oxygen, which was the most favourable composition to produce by combustion a brilliant light. In fact, they contained hydrogen, the most inflammable of gases; oxygen, without which all combustion is impossible; and finally, carbon, the disengagement of which puts in suspension in the flame of the hydrogen little corpuscules which, passing to a reddish-white, give brilliancy to the flame. Of the three acids, two were, by their physical properties—that is to say, by their consistence and whiteness—in the best condition possible for making the wax candles. The third, on the contrary, by its extreme fluidity, was an obstacle that it was necessary to surmount. Its reddish colour, the volatile matters that it contained, the smoke that is disengaged by an excess of carbon, rendered it unadapted for luxurious lighting. These principles once laid down, we perceive the means they used to obtain, in their purity, the stearic and margaric acids; they mixed the melted tallow with a base of soda or potash, and they thus got rid of the glycerine, which could be of no use. By adding a certain quantity of sulphuric acid, which has an extreme affinity for bases, they formed a sulphate of soda, and the three fat acids were set at liberty in a state of paste; the solid crystals of the stearic and margaric acids containing in their network the fluid oleic acid. An energetic pressure disengaged it mechanically, and the two acids remained pure in a state of white matter like alabaster, solid enough, and fusible at about 55 deg.

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* Stearine (from *stear*, suet), that part of oils and fats which is solid at common temperatures. The nature of these substances was first made known by Chevreul, in 1823, who showed that they were compounds of peculiar acids, with a base termed glycerine; of these compounds the chief are stearine, margarine, and oleine (from *elaion* oil).

Towards 1835, the application commenced on a great scale at the Usine de l'Etoile, extending into Germany, where the Austrians distinguished themselves notably in the manufacture, which established itself in England, where the powerful firm of Price and Co. produce immense quantities of fat acids, and now all nations make large quantities of the stearine wax candle, more or less handsome, particularly since the economical method of distillation has allowed a decrease in the price by making use of matters of less value, such as palm oil and all kinds of inferior fats.

The manufactory at Clichy, the description of which will give us an opportunity of furnishing a detailed account of the making of candles, is the last established. The company has studied rather to introduce processes for the purpose of bringing the manufacture to perfection, than the erection of one of those immense buildings that swallow up the bulk of the capital, leaving little or no residue for the carrying on of the business. The tallow factory, however, is necessarily a vast edifice, and its chimney is one of the highest. The only object of the company has been the manufacture of irreproachable products, and to raise the character of its manufacturing mark. Let us see what series of operations resulted from this. The first is the melting of tallow. No industrial manipulation is more infectious or more nauseous—none more repulsive for the neighbours. The factories where it is carried on are built as far as possible from the centre of habitation. The authority for establishing them is a sort of privilege. The use of the tallow candle, which scarcely extended to the South, where oil was abundant and very cheap, was extended, and became perfected in the North of Europe—in particular, in France. The butchers themselves melted their fat and made candles of it, towards 1016, a corporation of chandlers was established by Philip I., re-arranged towards 1470, and kept its privileges to the end of the last century. Moreover, without being as much shackled and as well regulated as formerly, it is, however, practised under a very active superintendence of the police prefecture and of the supervision of the butchers of Paris. The tallow arrives at the manufactory *en branche*, that is to say, as it comes from the offal-houses and butcheries. The sooner it is brought the better, especially in summer; in fact, the fat-matter is enveloped in fibrous cells, eminently liable to putrefaction, which decomposes rapidly at their contact. In order to disengage these fat-matters from the membranes which envelope them, two means are employed: the most ancient consists in melting the tallow in copper pans, then to extract, by strong pressure, all the liquid part, and having for remainder *des cretons* (the residue of tallow) in little loaves. The procedure employed at Clichy consists in reducing the fusion of the tallow into a liquid with an addition of sulphuric acid, which destroys completely all the membranes, and brings with it a certain quantity of glycerine, when they pour the mixture into large vats, capable of containing four or five thousand kilogrammes; they barrel up the tallow, after having previously added a little water and sulphuric acid; they then introduce a current of vapour at 133 degrees, by means of a serpentine pipe, perforated with little holes; ebullition commences, the cells open, and the membranes are destroyed. At the end of four hours, it is poured into crystallizing copper vessels and left to cool; they then rack and leave it to settle in forms of wood named *jalots*. The tallow then takes the form of cone-shaped loaves. By this process they withdraw about 88 to 100 per cent. of useful matter, already white, purified from all organic bodies not belonging to it, leaving a little glycerine, which it is necessary to get rid of altogether. This object is attained by saponification, that is to say, by the combination of the fat acids of the tallow with a basis. The tallow coming out of the melting-house in a state of stearine, the margarate and oleate of glycerine are collected in gigantic vats, capable of containing 10,000 kilogrammes of matter, and are put in fusion by means of an injection of vapour, admitted by a serpentine pipe at the bottom of the vat. They add lime, dissolved in water, which soon seizes on the acids, forms stereate, margarate, and oleate of lime. All the glycerine is racked and poured into the Seine, for they have not yet learned how to utilize it economically. The soap obtained by this operation is of a greyish white, and of great hardness. In order to separate the fat acids from it, they pound it, and throw it into great vats, lined with lead, where is already to be found the quantity of sulphuric acid necessary to neutralize the lime; a pipe heats this mixture by an injection of vapour, and soon a sulphate of lime is formed, drawn by its weight to the bottom of the vat, whilst the stearic, margaric, and oleic acids remain on the surface, presenting the appearance of a pretty thick liquid, of a reddish colour, and of a disagreeable smell. A series of canals, of a calculated inclination, conduct into little flat reservoirs, made of iron plates and disposed on props, one beyond the other. The liquid fills the superior reservoir, that which flows over falls into the immediately inferior scale, then into the third, and so on in continuation. In cooling, the matter coagulates, and, drawn from the mould, forms a large square of four centimètres in thickness, by fifty-eight in length and thirty-five in breadth. From these squares it is now necessary to withdraw the oleic acid that they contain. Chemistry is not competent to perform this task; mechanism can succeed, thanks to the hydraulic press. But it is not one simple pressure which can obtain this result; two, three, and even four, are necessary. The first is a cold pressure. The tablets, placed horizontally, enveloped in coarse woollen stuff, horse-hair, or even ordinary hair, called *malfils*, and separated by plates of iron, are piled up under an ordinary hydraulic press, and compressed as much as possible. A great part of the oleic acid contained between the crystals of the two other acids passes off in a reddish-brown liquid, and descends to the cellars, where we shall find it by-and-bye. The cakes, now flattened, still contain a large quantity of the proscribed liquid, as one can judge by the large red spots which mottle them. They then submit them to a final pressure, which should entirely purify them. This pressure, which is accompanied by heat, is effected by means of ingenious machinery, brought to perfection by M. Galabrun. The tablets are placed vertically between horse-hair *etreindelle* covered with a printer's blanket, separated from each other by one of sheet iron, composed of two plates supported by props, leaving between them sufficient space for an injection of vapour, which maintains them at about 80 degrees. The hydraulic press is made horizontally, and, thanks to the clever invention of M. Galabrun, the vapour continues to penetrate between the plates by pipes made of caoutchouc.

The oleic acid squeezed out runs into the inferior part of the preparation, and goes to find that which has deposited itself there in escaping from the cold presses. There they make it pass through felt filters, in which it still leaves a good part of the stearic and margaric acids, which again undergo pressure. The oleic acid, disembarrassed of the useful matters which it contained, is casked, given up to commerce, or employed in the manufacture of soft soap; for the Clichy manufactory, like almost all others, possesses an important soap-making department. The tablets of stearic and margaric acids, freed by the hot pressure of the greater part of the oleic acid, are afterwards employed in making candles. The first kinds for commerce are made thus:—At Clichy the loaves undergo a second hot pressure, and they then obtain the stearic acid almost pure, of a beautiful white, translucent colour, and deprived of odour, of a pretty good resistance to fusion, presenting, in fact, all the qualities which in commerce have given it the name of *extra-double*. In coming out of the presses, the stearic acid is purified by several washings in water, at first acidulated, to purge from all foreign matter, and particularly from the oxide of iron by oxalic acid, to take away every trace of lime, then clarified *a l'albumine*. Thus purified, it crystallizes with an excessive rapidity, which would present a great difficulty in the making of the candle if it were not remedied. Formerly, they added in the coppers a small quantity of arsenic acid, which prevented, it is true, the crystallization, but was entirely injurious to the consumer. In a great many stearine manufactories they employ the old candle-moulds, slightly warmed before pouring in the liquid stearic acid. At Clichy they make use of apparatus by means of which they can easily make 40,000 candles per day. This apparatus has the advantage of being heated and cooled at will, of being worked by women and children, and owes its rapidity of execution to the clever mechanism which supplies it with a series of wicks without end. In coming out of the mould, the candles are exposed to the air on frames of latticework; there they undergo the discolouring influence of light, and become of an absolute whiteness. After forty-eight or sixty hours of exposure, according to the season, they bring them to the cutting machines. An endless chain, composed of parallel staffs, receives each candle at the moment in which, escaping from the notches of the cylinder, it is cut by a circular saw, warmed by friction against two corks, which press it lightly. During their passage on the endless chain, a brush, animated by a to-and-fro movement, washes and rubs the candles, on which fall some drops of water charged with carbonate of soda; from thence they pass over the polisher, a machine in which the brushes are replaced by plugs of flannel, which gently polish the cylindrical surface, and give it an agreeable brightness. The candles are then finished; but their fate varies according to their degree of perfection. Those which contain any defect whatever are broken and again melted down; those which satisfy in every way the experienced eye of the persons charged with the examination of them, are recognized by the house and judged worthy of bearing its mark. By means of a little apparatus in silver, maintained at a heat of about 212 deg. Fahr., they impress the word "Clichy," and the candle goes to the packing-room with its fellows, or, if it present an unusual degree of perfection, it is judged worthy of being decorated. The idea of decorating the candle by ornamenting it with paintings, escutcheons, and figures, is an elegant and graceful invention, that the proprietor of the manufactory, M. Casinberche, has developed with the same certainty of purpose which distinguishes all his enterprizes. Nothing in the world is more unseemly than to see in rich candelabra with costly carvings, or even in small delicate porcelain candlesticks finely painted, thick ugly candles, very unjustly called wax candles, yellowish and dropping grease, with a shrivelled-up wick, emitting with an unpleasant smoke an insipid and repulsive odour.

Exaggerating the contrary idea, the manufactory at Clichy has had the foolish prodigality to paint on the candles some *chefs d'œuvre*, signed by the best names of the manufactory of Sevres; the ever-to-be-regretted Mdme. Laurent, and other artists of talent, have executed charming subjects on stearine. But we must not forget that ornamental painting has its laws. Execute on the candle ornaments of every kind—flowers, birds, chimeras, but do not trace portraits thereon. Nothing can be more tasteful—nothing more simple and more natural—than to have on the candle of which you make use your armorial bearings, if you have inherited them from your ancestors This kind of ornamenting is still expensive, but researches actively and cleverly conducted will soon lead to a reduction in the cost, which will generalize the custom in every house priding itself on elegance.—*Technologist.*

TO CORRESPONDENTS.

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H. K. (Edinburgh).—You will find the slip in our columns of Miscellanea.

H. STAUNTON (Belfast).—Many formulæ are given for determining the flow of water over weirs. Etellweyn's is considered one of the best.

G. B. (Darleston).—There can be no question that cooling either steel or iron in oil confers qualities which can never be gained by quenching them in water. Besides a positive increase of strength, oil imparts a peculiar toughness, which renders this mode of tempering admirably suited to the hardening of saws, &c.

RECEIVED.—D. K. C.—M. A. S.—R. M. L.—R. L.—H. K.—D. K.—P. N. S.—T. D.—H. P.—E. & G.

Correspondence.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

STEAM-PUMPS AT THE INTERNATIONAL EXHIBITION.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

> "Now, the hostility of words we may despise, and even the discourtesy which seems inborn in the American nature we may pass over, however irritating may be sometimes the display of it. But, an actual invasion of our rights it is impossible to disregard."—*The Times.*

SIR,—Will you allow me the use of your columns to state, that I have seen a notice of my Report to the Admiralty on the steam-pumps at the International Exhibition in the *Engineer* of last week (in which my name is actually spelt with an *e* final); and that, while acknowledging the uniform courtesy and gentlemanly reticence (without a taint of provincialism) with which that paper deals with the subject—indeed, I may say with everything it undertakes to criticize—it is, nevertheless, my intention *not* to reply in the columns of the said paper (which are always, no doubt regardless of exposure, most freely placed at the service of correspondents who find occasion to correct the errors of the said paper); but I intend to publish my own account of the trials of the steam-pumps, with every necessary detail of evidence or of explanation, in my work, now in preparation, on "The Exhibited Machinery of 1862."

Possibly the writer of the said article, in the said paper, finds it difficult to forget that little matter of a discussion on boiler explosions, as to which *vide* the Mechanics' Magazine, for May 3rd and 10th, 1861.

I am, Sir, your obedient servant,
D. K. Clark.
11, Adam-street, Adelphi, June 23, 1863.

Miscellanea.

A town in Massachusetts manufactured 1,500 lb. of leather daily from leather scrap and old rope.

Water-tube grate-bars are extensively used for anthracite-coal-burning engines in America.

Steam ports, 18¾ in. long, have been employed in locomotives with 15 in. cylinders.

Iron railroad cars have been used in America. They are too heavy to deserve general adoption.

Steam has been raised in four minutes in the boilers of steam fire-engines.

The repairs of locomotives average 3d. per mile run.

Cast-steel tyres have been successfully welded. The process is both difficult and uncertain.

Messrs. Caird and Co. have received an order from the West India Royal Mail Steamship Company for a screw of 2,434 tons burden, and 500-horse power. The machinery will embrace surface condensation, superheated steam, and a steel shaft by Krupp, of Essen.

Telegraphic communication between Malta and Alexandria has been interrupted for two or three days. This accounts for the absence of telegrams now due with news from India and China.

Those in authoritity seem scarcely satisfied with the prospects of a satisfactory result from the introduction of cupolas on board ships of war, and it would not be surprising if the system of double screws did away with the presumed necessity for employing Capt. Coles' invention.

A good deal has been said lately in London about "steam trumpets" as a mode of signalling on railways. Is appears that these instruments are the invention of a Dr. Upham, of Boston. About a year ago he obtained the use of two locomotives for the purpose of an experimental talk by the sounds of the steam-whistle. The inventor had attached several contrivances to the whistle in the shape of bells, trombones, and clarionets; and by means of these he was enabled to represent the sounds of the alphabet by very different sounds. He found that by their means he could could convey a message to a distance of three miles, which could be heard and understood even amid the more immediate sounds produced by the movement of a railway train. The doctor has, it is said, found it possible, by the simple trumpet, to transmit any message, however long or complicated, the distance of a mile.

An interesting communication from M. Guerin-Menneville on "Silk Culture," was read at the last meeting of the French Academy. This gentleman has succeeded in habituating silkworms, hatched from Japanese eggs (*B. yama-mai*), to feed on oak-leaves, and his Paper was accompanied by some cocoons produced by worms so fed. He expressed hopes that the discovery might lead to the extension of silk culture in France, and we may add that it affords some hope that it might be profitably carried on in England.

The Harbour Trustees have made arrangements to form a west-end harbour at Greenock, of 1,000 ft. in length from east to west, 420 ft. in breadth at the widest point, and 14 ft. in depth at low water, and covering a space of nine acres, or, double the area of the Victoria Harbour. It was proposed to lay the material dredged from the harbour in the timber pond west of Albert Harbour. The new harbour will be wider than the Liverpool docks, with few exceptions.

On Wednesday afternoon, Messrs. Scott and Co., of Greenock, launched from their shipbuilding yard the first of three paddle-wheel steamers for a French firm, the "Compaignie Générale Transatlantique," of 3,250 tons, 346 ft. long, 46 ft. broad, and 31 ft. deep, having side lever engines of 850-horse power nominal, the diameter of the cylinders being 94 in,. and that of the paddle-wheels 36 ft. The vessel was named the "Washington," and is intended for the Havre and New York passage. The company are subsidized by the French Government to the extent of £372,000.

A case was decided in the Jury Court, Edinburgh, before Lord Barcaple, last week, in which Messrs. Cooper and Wood, bottle manufacturers, Portobello, claimed £1,000 damages against the North British Railway Company for injury sustained by the house and grounds of Baileyfield, Portobello, of which the pursuers are proprietors, from smoke, dust, and gases discharged from the defenders' works for converting and hardening iron rails. The works in question were erected about three years ago on a narrow strip of ground left vacant between a curve formed for the improvement of the Leith and Portobello branch line and the original railway track, and they were separated from Baileyfield only by the railway line and the Leith and Dalkeith road running alongside. The pursuers alleged that clouds of smoke and dust, as also deleterious gases, were constantly thrown out in large quantities from 14 low chimneys, rendering the residence at Baileyfield unhealthy and unsafe, or, at least, uncomfortable, and drying up and wasting the trees, shrubs, and vegetation. It was accordingly put in issue whether the house and grounds of Baileyfield were deteriorated by the defenders' works, and the comfort of the occupation impaired, to the nuisance of the pursuers and to their loss, injury, and damage. A large number of scientific witnesses, including chemists, medical practitioners, architects, and horticulturists were examined on both sides. The evidence was to a great extent conflicting, but it seemed to be proved that the vegetation had, since the erection of the furnaces, been considerably injured, and that the comfort of the occupation had been interfered with. The jury were divided in opinion, but by a majority of nine to three they found for the pursuers, with £200 damages.

Mr. Robert Hunt, the keeper of the mining records in the Museum of Practical Geology, London, has published a valuable series of mining statistics, showing the extent and probable duration of the mineral resources of this country. Coals stand at the top of the table, as three-fourths by value of our mineral produce annually consists of this article, so indispensable to our manufacturing and maritime supremacy. We therefore learn, with something deeper than regret, that "the rate of exhaustion which is going on over our coal-fields still increases. From 3,052 collieries, there was used and sold in 1861, 83,635,214 tons. Two million and a-half tons were wasted in the process of working and burned at surface on the collieries of Durham and Northumberland alone. The total waste must, therefore, have been very large, although information thereof could not be correctly obtained." There is, also, a large waste in the actual consumption of coal in this country for domestic purposes, not alluded to by Mr. Hunt, that is not likely to diminish so long as coals are cheap. At present, we probably burn much more fuel in warming our chimneys than our rooms; but, if coals were to be permanently double the price they are now, ingenuity would soon find out the way to utilize that which we now squander. The year's produce from the principal coal-fields is shown by the following figures:—Tons in 1861.—19,145,000 from Durham and Northumberland; 12,196,000 from Lancashire; 9,375,000 from Yorkshire; 7,254,000 from Stafford and Worcester; 6,691,000 from South Wales; 5,116,000 from Derby and Notts; 11,081,000 from all Scotland.

The scientific news from Russia tells us of the discovery of a means whereby the mercury used in the manufacture of looking-glasses may be so hardened as to be rendered defiant of humidity, friction, or blows. The plate-glass thus prepared may consequently be transported to any distance without fear of damage; and the silvering being accomplished by a cheaper process than any yet known, the glass is 10 to 20 per cent. cheaper than at present.

The prizes offered by the Bombay Government, in November, 1862, with the view of stimulating and improving the cultivation of cotton, have been without any effect; and Government now states that the realization of good prices on the spot appears the best and most acceptable reward to the producer. The experiment made with Peruvian cotton seed at Coimbatore, in November last, has proved a failure. The plants appeared for a time healthy and promising, but were entirely destroyed by worms.

We learn from the *Liverpool Albion*, that on Saturday afternoon a new steam fire-engine was tried at the Fire-engine Station, Hatton-garden, in presence of Mr. Clint, chairman of the Watch Committee, Mr. Alderman Houghton, Major Greig, Councillors Crellin and Melladew, Mr. Duncan, the water engineer, and many other gentlemen. The engine was made at the works of Messrs. Lee and Larned, at New York, in which city it is stated to have been in operation for the last four years. It was brought over in the "Great Eastern," and is to be tried at the fire-engine competition in London, on the 1st of next month. It is very powerful and works easily. The steam was got up to working trim in about fifteen minutes from the time the fire was kindled. With a nozzle 1¼ in. in diameter, with a pressure of 80 lb. of steam to the square inch, it threw a stream of water to a height of about 150 ft. The cost of the engine is said to be about £1,000.

The example of England in establishing the noble precedent of International Exhibitions, after finding imitators in the United States, France, and elsewhere, has at last aroused the emulation of the phlegmatic Germans. The free city of Hamburg will next month be the scene of an "International Agricultural Exhibition," to commence on Tuesday, the 14th, and continue one week. This exhibition will be confined to live stock and agricultural productions, including all mechanical aids to agriculture. The Exhibition Committee have entered into negotiations with various steamship and railway companies, to obtain reduced tariffs on freight for contributions from numerous points on the Continent. The most important agricultural societies of all countries, including our own Royal Agricultural Society, have promised to give all the aid and support in their power. The board of directors of the proposed Exhibition—which will be held just outside of the city of Hamburgh—includes men who are prominently identified with commerce, literature, science, and agriculture.

The Staffordshire Rolling Stock Company is announced, under conditions that promise to secure for it a degree of success equal to that attained by similar undertakings now in operation. The object being to construct, purchase, maintain, and lease carriages and waggons to railway companies, collieries, and commercial firms. It is intended to secure an established local company, with a paid-up capital of about £10,000, which is now paying 7½ per cent. per annum. This business is stated to be augmenting, so as to warrant a considerable addition of capital; but no profit or bonus is to be paid upon its sale or surrender. These are favourable circumstances. The proposed capital is £50,000, in £10 shares, and the direction is so constructed as to secure large and valuable connections.

A simple and ingenious apparatus has been invented for indicating to travellers on railways the name of each station as it is approached by the train. Is is in the form of a small dial plate.

A Steamboat in 1788.—In a letter from Dr. Franklin to Dr. Ingenhauz, dated Philadelphia, October 24, 1788, the doctor remarks—"We have no philosophical news here at present, except that a boat moved by a steam engine rows itself against tide in our river, and it is apprehended the construction may be so simplified and improved as to become generally useful."

Clifton Suspension Bridge.—The works in connection with this bridge are now making rapid progress. The last of the nine wire ropes necessary for the construction of the temporary bridge has just been successfully carried across. These iron wire ropes (each of which weighs two tons, and is of extraordinary strength) are now being finally adjusted. Three of them fall upon either side of the position which will be taken by one set of the main chains. These six ropes will be strained up level with each other, and upon them planks will be placed transversely and secured by bolts, forming a platform 7 ft. in width from tower to tower. Two others of the chains will be placed 3½ ft. above this platform, so as to form hand rails to the temporary bridge for the safety of the men engaged upon it. At a greater altitude than all the others is placed the ninth wire rope, on which will run the traversers which will be used in conveying the materials to their required positions. To facilitate the construction of the temporary bridge, a "cradle" has been made, consisting of a light iron frame and wooden floor, 7½ ft. square, which will run on the wire ropes described as the hand-rail ropes. Workmen will be sent out to the middle of the span in this cradle for the purpose of fixing the floor of the platform, and will be propelled to and fro by means of a crab. The ends of the ropes on each side of the river are secured to four balks of timber, which are bolted together, and firmly bedded into the solid rock with bricks and cement. It may be added that the span of the bridge is 702 ft., and the height from the low water to the carriage way 270 ft. The engineers are Messrs. J. Hawkshaw and W. H. Barlow; and Messrs. Cochrane and Co., of Dudley, are the contractors.

The Great Trial of Steam Fire-Engines.—The forthcoming trial of steam fire-engines is fixed to take place at the Crystal Palace on Wednesday next, the 1st of July. The committee, which is presided over by the Duke of Sutherland, offers four prizes—two £250 each, for steam-engines not exceeding 30 cwt., and two prizes of £100 each, for larger class engines not weighing more than 60 cwt., the weights not including coal, water, hose, &c. The authorities of New York have sent over their finest "fire steamer" to compete for a prize. She is named "The Manhattan," and is described as the most efficient for power out of the thousand New York engines. The number of manufacturers who have entered their names for the trial does not exceed 12 or 14. The judges are as follow:—The Right Hon. the Earl of Caithness, the Duke of Sutherland, Lord Richard Grosvenor, M.P., Mr. J. G. Appold, Mr. J. F. Bateman, Mr. W. M. Brown, Mr. T. M. Crampton, Mr. W. H. Crosland, Mr. W. Fairbairn, Mr. T. Hawksley, Mr. J. E. M'Connell, Mr. Henry Maudslay, Mr. J. Matthews, Mr. Nasmyth, Mr. J. Penn, Mr. Smith, and Captain E. M. Shaw, the superintendent of the Fire Brigade. They have selected the northern falls or cascades to the large lakes in the Crystal Palace ground as the site where the different engines will be tested. Captain Shaw has invited the chiefs of the numerous fire corps at Berlin, Paris, Hamburgh, St. Petersburgh, as also at New York, and most of the American States, to London, as his guests, to be present at this trial, which no doubt will be a most exciting affair.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other Papers are hereby warned not to produce them without an acknowledgement:—

Steam Engines, &c., 3163.
Boilers and Furnaces, 3128.
Roads and Vehicles, including railway plant and carriages, saddlery and harness, &c., 3139.
Ships and Boats, including their fittings, 3177,
Cultivation of the Soil, including agricultural implements and machines, 3132.
Food and Beverages, including apparatus for preparing food for men and animals—*none.*
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c., 3131, 3143, 3150, 3152, 3154, 3155, 3156, 3158, 3168, 3169, 3180.
Buildings and Building Materials, 3136, 3138, 3164, 3166.
Lighting, Heating, and Ventilating, 3145, 3147.
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c., 3129, 3130, 3133, 3140, 3142, 3144, 3160, 3161, 3165, 3171, 3174.
Metals, including apparatus for their manufacture, 3153, 3159, 3176.
Chemistry and Photography, 3134, 3157, 3175, 3178.
Electrical Apparatus—*none.*
Warfare, 3135, 3141, 3149, 3173.
Letter-Press Printing—*none.*
Miscellaneous, 3137, 3146, 3148, 3151, 3162, 3167, 3170, 3172, 3179.

3128. J. Napier and W. J. M. Rankine. *Improvements in boilers and valvular mechanism for steam engines.* Dated October 21, 1862.

This invention comprises improvements in the arrangement or construction of boilers for supplying steam to motive power engines, and improvements in the valvular mechanism for regulating the admixture of the steam to such engines, the improvements in boilers being carried out under various modifications. One modification of steam boiler comprised in the present invention is designed more particularly, although not exclusively, for steam of high pressure for marine engines. The boiler consists of four vertical cylindrical shells, with hemispherical tops, and furnaces are formed in the lower parts of two of these shells. The furnace spaces are, at their upper parts, each gradually contracted into a flue, which is bent into a horizontal direction somewhat below the water surface line, and which crosses into one of the two shells having no furnace. In each of these shells the flue is bent downwards and expands into a chamber traversed by vertical tubes having the water inside them, and the fire gases pass downwards through this tube chamber, and off by a flue or uptake rising up centrally between the four shells or boilers. Instead of the flue first rising upwards from each furnace, the furnace and its shell may be constructed to deliver the fire gases directly and horizontally into the flue, crossing into the other shell, and this latter with its tube chamber may be extended downwards considerably below the furnace shell, a fan or other known means being employed to start or ensure a proper draught. The improvements in valvular mechanism relate to that class which contains a double slide and a link motion. In an arrangement embodying these improvements the slide next the valve seat is moved by a pair of eccentrics and a link motion in the ordinary manner, and the position of those two eccentrics on the shaft is fixed with reference to the exhaust only, so as to make it begin and end at the instants most suitable for efficient exhaustion of the steam, without regard to the admission or cut-off. The admission of the steam takes place through a pair of openings in the first slide. The cut-off is effected by means of a second slide behind the first slide. This second slide consists of one plate with an opening in the middle, or of two connected plates with an opening between them, the two endmost edges of which opening overlap the openings of the first slide inwards to the extent required for the lap necessary in order to produce the expansive working. The second slide is moved by means of a third eccentric fixed on the shaft in such a position that the centres of the three eccentrics form a triangle whose acute angles at the centres of the forward and backward eccentrics, respectively, are equal to the angular advance necessary to produce the admission and cut-off required in full forward and full backward gear respectively. The expansion is varied by means of the link motion in the ordinary way. *Patent abandoned.*

3129. W. E. Gedge. *An improved elastic fastening.* (A communication) Dated November 21, 1862.

This invention consists in the application to a glove of any description of a piece of elastic, such as india rubber, covered with silk or other appropriate material, for the purpose of suppressing every description of fastening hitherto used, such as buttons, clasps, or others more or less inconvenient. This elastic fastening (which may be compared to one of the side springs now commonly used in boots), is placed in that part of the glove which encloses the wrist, and in preference beneath the hand. It preserves the shape of the glove, and also prevents its tearing or bursting at the seams, as the glove will yield to every motion of the band. *Patent abandoned.*

3130. D. Saul and M. Morris. *Improvements in crinoline skirts.* Dated November 21, 1862.

This invention consists in making the skirt of a continuous length of crinoline wire or other material, which is wound in a spiral form from one end of the skirt to the other, thus avoiding the necessity of fasteners for securing the ends of the wire, excepting only the fastening at each end of the skirt; the spiral coils of wire or other material must be connected by the usual suspenders. The improved apparatus for manufacturing crinoline skirts consists of a central shaft on which are fixed two or more sets of wires carrying ribs longitudinal with the shaft, the arms of unequal lengths; they are moveable on the shaft, and by varying the position and lengths of the wires, any required shape can be given to the crinoline skirt. As it is desirable in some cases to make the upper part of the crinoline skirt higher at the back than the front, the inventors bind the wire or other material around fixed studs attached to the apparatus above described; these studs are placed at the required distance apart, and as the wire or other material is bent around them, the desired space in front is left open. By this means the abrupt ends of the wires, hitherto unavoidable in making such skirts, are dispensed with. *Patent abandoned.*

3131. J. Steart. *An improved method of extracting the fibre from zostera marina and other aquatic vegetable productions.* Dated November 21, 1862.

In carrying out this invention, the inventor submits the plant or weed to various degrees of pressure, by means of rollers or otherwise, for the purpose of bruising or loosening the outer sheath or skin, and extracting the saccharine matter. He then places it in a mash bath of fresh water at a temperature of form 85 to 110 deg. Fahr. It is then treated in a bath—being a preparation of fish and water, denominated a pure bath—at a temperature from 80 to 110 deg. Fahr. for a suitable length of time; and, lastly, to pressure and friction at a temperature from 75 to 100 deg. Fahr. By this process the outer sheath or skin of the plant or weed is decomposed and removed, leaving the fibre in an uninjured state. It is then dried and cleansed, and fit for manufacturing purposes. *Patent abandoned.*

3132. T. Walker. *Improvements in utilizing sewage matters, and in the means or apparatus employed therein, part of which improvements is also applicable to raising and forcing other fluids.* Dated November 21, 1862.

This invention relates to means by which sewage matters may be collected, and the more solid or heavier fertilizing parts thereof retained by subsidence, and then distributed over a district for agricultural or horticultural purposes. For this purpose the patentee forms a conduit from the sewer or drain to the lower part of a well or reservoir with the side or sides thereof inclined. Whilst the heavier particles will by gravitation descend to the lower part of such well or reservoir, the more liquid portion thereof may flow over by a suitable passage into the sewer or drain again, or into another reservoir or reservoirs. The matter collected by subsidence in the first well or reservoir, he draws from the lower part thereof by means of a pump through suitable piping, and thence by other pipes he conducts it to other tanks or receivers, which he calls field or mud tanks, or reservoirs at distances apart, as may be required. These latter field or mud tanks may be formed deep at one end, inclining upwards to the opposite to facilitate emptying them. The fluid matters from the first well or reservoir may be caused to flow into troughs or gutters laid so as to distribute the fluid matters over the district for irrigation. The pumping apparatus he prefers to employ, and which may be worked by a steam engine, or other suitable power, is formed into a chamber connected to one end, or one to each end, of the working barrel of a pump, having a flexible diaphragm across each chamber to prevent the sewage matters coming in contact with the clean water or oil in the working barrel on one or both sides of the piston. Pumping apparatus similarly arranged is also applicable to other cases where it is desirable to keep the working barrel and piston free from injurious effects of the matters to be raised or forced. Sluices or stop-ways are provided to regulate the direction of the various flows, or to close the passage by any of them as required. *Patent completed.*

3133. C. Wagner. *Improvements in strengthening, securing, and rendering more durable the soles or bottoms of boots, shoes, and other covering for the feet.* (A communication.) Dated November 21, 1862.

This invention consists, mainly, in attaching the outer to the inner sole by metallic rivets or studs, metallic washers being placed over one or both ends thereof. *Patent completed.*

3134. R. W. Swinburne. *Improvements in the manufacture of soda.* Dated November 21, 1862.

This invention consists in manufacturing soda from chloride of sodium fused under heat, by injecting into the fused mass at the bottom, by preference, or below the surface thereof, superheated steam or other suitable gaseous fluid. The agent so introduced is brought into contact with every particle of the fused mass, the chloride of sodium is decomposed, hydrochloric acid is formed and may be secured in any suitable holder, while soda or carbonate of soda remains in the vessel in which the operation has been performed. Instead of acting on the chloride of sodium in a state of fusion, the invention also consists in vaporizing it, and in injecting superheated steam, or other suitable gaseous fluid, into and amongst such vapour while contained in a heated retort or vessel. *Patent completed.*

3135. G. G. Sanderson. *Improvements in armour for fortifications, and floating and other batteries.* Dated November 21, 1862.

For the purposes of this invention, the inventor employs bars of triangular section formed by rolling in a manner similar to that in which railway and other bar iron is commonly made. The base of the triangular section is made flat, and its sides are made the one with a projection and the other with a corresponding recess. The apex of the triangle is, by preference, truncated, and the projection and recess at the sides are conveniently made to occupy respectively about one-half of the length of the side. These rolled bars are to produce the armour placed side by side on a suitable backing or frame, the bars being arranged alternately, so that, if the base of one bar is inwards towards the backing or frame, the bars next it on either side are placed with the bars outwards to form the face of the armour. When the bars are thus arranged, the projection on the one will enter the recess on the other, and so on throughout the series, and the bars form an armour with a flush surface both on the face and at the back. The bars are secured to the backing or frame by bolts at intervals passing through the armour and the backing or frame. *Patent abandoned.*

3136. J. Taylor. *Improvements in the manufacture of tiles, or moulded blocks for building purposes.* Dated November 21, 1862.

For the purposes of this invention, the patentee, in manufacturing moulded, bent, or angular tiles or lumps, each having two outer surfaces at right angles to each other, a die or moulding orifice is so formed that several of such bent or angular tiles or blocks shall be moulded together in one block, and so connected to each other that they may be dried and burned, and transported to any distance before they are separated for use. And the construction of the die or moulding orifice is such that some of the bent tiles (which are all of the same section and dimensions) are within, whilst the others form the outside of the block. The construction of die or moulding orifice preferred is suitable for moulding or forming six bent tiles at the same time slightly connected together, by which not only are they retained in form during the drying and burning processes by reason of the longitudinal interstices or passages, but the processes of drying and burning are facilitated. The die or moulding orifice is of a rectangular figure, and produces four bent tiles, one at each angle of the die, and two similar bent tiles on the inside of the mass, moulded or formed by expressing brick earth or clay through the die. *Patent completed.*

3137. C. A. Orth. *Improvements in apparatus for obtaining and applying motive power.* Dated November 21, 1862.

This invention is carried out in the following manner:—Two sets of rollers or wheels are arranged at one side of the machine; each set is composed of three rollers or wheels arranged one over another, and kept connected by teeth or cogs; the smooth surface of each roller is also in contact with the one next over it. The patentee distinguishes the three rollers of each set as A, B, C, calling the lowest A, the next over it B, and the uppermost C. The rollers A—that is the lowest of each set—are supported on a rack or toothed base-plate. On the rollers C is another rack or toothed plate on which work too other rollers (one over each of the sets A, B, C), and on these rests a beam or bar, which he calls a pressure beam, and to which pressure may be applied by a screw or otherwise. Within each of the lowermost rollers is a smaller roller, on which rests a platform or carriage which supports a contrivance called the union lever, which is placed between the two sets of rollers, and consists of two portions, an upper and a lower portion, held together by guide pieces; each portion is composed of two arms crossing and jointed to each other near one end, and jointed at that end to links or other arms; the arms or limbs of the union lever approach and recede from each other somewhat in the manner of what is called the lazy tongs. To the links are attached arms or bars which he calls balance-pieces. To the rollers B are attached horizontal bars or rods, which are connected to, and actuate, the union lever, and to these are also connected slide-pieces; cross rods are carried from the end of each balance-piece to the centre of the other, where they are connected to the links of the union lever. The whole of the foregoing arrangement of apparatus is repeated at the opposite side of the machine, and angle cranks or angle-cranked shafts are carried from the balance-pieces on each side of the machine to the balance-pieces at the opposite side of the machine. On the cranked shafts are eccentrics which work a compound lever or lazy tongs contrivance, situated between the two arrangements of apparatus. Levers are carried from the cranks to the rollers C to regulate the level. On pressure being applied to the pressure beam, such pressure will be transmitted downward through the topmost rollers and plate on which they rest to the rollers A, B, C, thereby working those rollers to and fro, or inward and outward, in alternate directions, by which means a true level is maintained. The rollers B actuate the union lever which drives the crank shafts, and these transmit motion to the compound lever from which motion can be communicated as desired. *Patent completed.*

3138. S. and C. Deacon. *Improvements in tops, caps, and windguards for chimneys, and in apparatus for cleaning the same.* Dated November 21, 1862.

This inventions consists in constructing the covers of chimney tops, caps, or windguards in such manner that the said covers shall open and close, that is to say, they shall be opened by the brush or ordinary cleaning instrument when it moves upward, so as to allow such brush or instrument to pass up through the top, and shall close or return to their previous position when the said brush or instrument is lowered or withdrawn. The invention next relates to an improved cleaning apparatus, the object of which is to clean the inside surfaces of the guards, shields, or plates fixed outside the openings or slots of windguards, chimneys, or caps. This cleaning apparatus consists of scrapers, brushes, or other cleaning appliances fixed to a ring-band or frame by shanks which pass out through the said slots or openings, the ring-band or frame being within the body of the cap, windguard, or chimney top. When the usual brush or cleaning machine is pushed up against the ring-band or frame, the latter is forced upwards, and of course carries with it the scrapers or other cleaning appliances attached to it, so that these rub against and clean the inside of the guards, and when they reach the top of the slots or openings the brush clears the ring or frame, and the latter drops to its previous position and leaves the brush free to pass upwards. *Patent completed.*

3139. A. Sutton. *An improved construction of time indicator for public vehicles and other uses.* Dated November 21, 1862.

This invention consists in mounting upon any convenient part of the carriage a clock movement provided with a double set of index hands and a divided dial, whereby the hirers of public vehicles may be informed of the amount of fare for which they are liable, and the proprietors of such vehicles of the earnings of the driver. *Patent completed.*

3140. W. E. Gedge. *An improved elliptical compass.* Dated November 22, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3141. W. E. Nethersole and C. Buckland. *Improved safety signals for firearm practice.* Dated November 22, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3142. M. Mishores. *Improvements in the construction of handles for umbrella, parasol, or other like sticks, from soft canes.* Dated November 22, 1862.

This invention consists in introducing a piece of wire through the centre of the cane longitudinally, and then bending it half round, or other suitable shape, at one end to serve for the handle. A little of the extremities of the wire protrudes on each end of the cane, and have a screw thread cut on them, one to screw into the stick of the umbrella or parasol, and the other to screw on an ornament to finish the end of the cane. *Patent abandoned.*

3143. C. De Bergue. *Improvements in machinery or apparatus for the manufacture of metal reeds for weaving.* Dated November 22, 1862.

This invention relates—1, to the application of files for equalizing, rounding, and smoothing the edges and surfaces of flattened metallic wire, as produced by, or after it has come from, the operation of ordinary flatting rollers; 2, to giving a finishing polish to the edges and surfaces of the flattened wire after it has been properly shaped or treated by the filing machine; 3, to making up the prepared wire into reeds. We cannot here give space to the details of the invention. *Patent completed.*

3144. C. Powell. *Improvements in watches and other timekeepers.* Dated November 22, 1862.

The patentee claims—1, screwing the pillars into blank or blind holes; 2, sinking the main spring into the pillar plate on either side; 3, the circular spring click described; 4, the hook; and lastly, connecting maintaining power wheel by two or more slots and screws to the great wheel, all in the manner shown and described with reference to the drawings. *Patent completed.*

3145. W. Clark. *Improvements in candle lamps.* (A communication.) Dated November 22, 1862.

In these lamps the patentee encloses the flame of the candle, or other luminary employed, within a globe or chimney of transparent material, mounted on a socket having an up-and-down movement for the purpose of raising or lowering the globe, so as to enclose or expose the light as desired. This globe may be maintained in position in a self-acting manner by the action of a spiral spring, which raises the socket to its original position, while it, at the same time, may be readily lowered for the purpose of uncovering the wick in order to light it. The candle or taper is enclosed in a socket or tube, being retained therein by a cap fitting on the upper end, or gripping pieces may be applied in lieu of the cap. In this manner the wick will always be on a level with the cap, as the lower part of the candle is pressed upwards by a spring contained within the socket in the same manner as a coach lamp. This lamp is especially applicable on board ship, in which case it is carried in gimbals, in order that it shall retain a vertical position, whatever may be the motion of the ship, while the spiral spring for securing the globe in position on the flame is dispensed with, and a weight applied to the stem of the lamp. *Patent completed.*

3146. A. V. Newton. *Improvements in machinery for cutting corks.* (A communication.) Dated November 22, 1862.

The object of this invention is to cut by a machine directly from a slab of cork wood, corks either of cylindrical form, or of any degree of taper that may be desired; and the invention consists mainly in the use of certain changeable patterns and adjustable screw clamps. The patterns are of cylindrical or conical form, and are attached to, and are concentric with, the rotary shaft or spindle which carries the cutters. *Patent completed.*

3147. J. Webster. *Improvements in the construction of burners and blow-pipes.* Dated November 22, 1862.

The patentee claims—1, the improvements in the construction and arrangement of the several parts of burners, whereby oxygen gas may be supplied to the flame produced by carburetted hydrogen gas, and the means by which the supply of both gases is regulated; 2, the improvements in the construction of wick lamps, by which a current of oxygen gas is supplied to the flame produced by the combustion of fixed oils or hydro-carbons; 3, the improved construction of oxyhydrogen blow-pipe, as set forth and specified. *Patent completed.*

3148. T. J. Searle. *Improvements in apparatus for raising and forcing water or other fluids.* Dated November 24, 1862.

This invention is carried out as follows:—Of any suitable materials, and to any required dimensions, the inventor forms a circular or other shaped framework; and on one or more parts of the same he raises or makes to any required size, and in any convenient position, a sectional chamber or chambers, the same being a part or parts of a circle. He provides an axle, and fits the same transversely in or near the centre of the framework. The chamber or chambers are constructed of metal, or of any other suitable material; and, if two are used, they are fixed right and left of the centre or otherwise; the acute angles of the same are fixed conjointly to, over, and around a part or parts of the axle, or otherwise, and each chamber is made air and water tight. Inside each of the chambers, fixed to, and radiating upon, the axle or other provided axle, there is a single, or, if two chambers, a conjoint moveable limb; the same is made practically to fit and act water-tight in the interior section of the chamber or chambers. A curved rod or rods enters or enter the chamber or chambers through a water-tight package, and the end or ends of the same is or are fixed to the moveable limb or limbs, and it passes through a suitable aperture or apertures into the chamber, or from one chamber into the other, as may be required, for the purpose of conveying the motive power. The moveable limb or limbs radiate or swing to and fro inside the chamber or chambers on the axle or other provided axle. Suitable valves are provided in any suitable part of, or in any convenient position contiguous to, the chamber or chambers, and connected with the same, for the ingress or egress of the water or other fluids. Valves may be inserted in the moveable limb or limbs, if from position or construction used it is necessary. A lever (or levers) of suitable construction, exterior of the chamber or chambers, is fixed on, or radiates on, a part of the axle, and moves the axle, or is fixed on or moves another provided axle to communicate motion either direct to the axle and limb or limbs aforesaid, or to the rod or rods, and is fixed thereto, in any suitable way and part, as may be required. Any other suitable gear may be adopted and used with the apparatus described. The apparatus may also be constructed for a force pump, a carriage engine, or a hand engine, by affixing suitable additional apparatus or means thereto. The entire apparatus may be fixed in any suitable position. In the above description, it is vertical. The motion of the fluids may be either in unity or otherwise. The curved rod or rods, also the axle or axles, used may enter the chamber or chambers at any required part of the same. The entire apparatus may be constructed either single or otherwise, to suit the special purpose required. *Patent abandoned.*

3149. J. B. Howell. *Improvements in the manufacture of armour and other plates, and in shot and shell.* Dated November 24, 1862.

According to these improvements, the inventor takes a number of bars of iron according to the area of the slab to be manufactured. He crosses and recrosses the bars, and distributes them over the area of the slab, and also throughout the thickness it is to be formed; these bars are supported one from the other, and otherwise, so as to present a skeleton (so to speak) of the slab to be formed. The bars, in addition to being crossed, may be in diagonal positions, or inclined to each other in all directions. He disposes this skeleton in a suitable mould, either in a furnace or otherwise, to form the slab or plate; and he then pours into the mould a quantity of what is known as homogeneous iron or cast steel amongst the bars of iron which have been previously heated to a welding heat, and a flux is applied which, together with the heat of the homogeneous metal, causes it to become thoroughly welded to the bars of iron, and become therewith a solid slab of metal. A plate is thus produced having a sufficiently fibrous nature to offer great resistance to the shock of shot, as not only does the fibrous nature of the bar iron remain intact, but the homogeneous metal or steel is much toughened in its nature, at the same time retaining all the known resisting qualities of the homogeneous metal or steel. These blooms or ingots may be subsequently hammered and rolled as may be required. According to the improvements in shot and shell, the inventor forms them of bar or other wrought iron, and makes them with a soft core or centre, covered by a partially converted or steel surface, and all or part of which surface may be hardened. He either first forms the shot or shell of the shape desired, and converts them by the ordinary process of cementation to the depth required, or he only partially shapes them, then converts, and afterwards completes them as desired. In some cases the entire circumference and force may be converted, or it may be the circumference and outer substance of the shot or shell only which is so converted. The conversion he continues till of a depth requisite, and according to the diameter of the shot or shell, and according to the purpose for which they are required. *Patent abandoned.*

3150. W. Clark. *Improvements in the means of obtaining a vacuum or partial vacuum as applied in the manufacture of paper.* (A communication.) Dated November 24, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3151. R. and W. Hawthorn. *Improvements in pump valves.* Dated November 24, 1862.

This invention consists in the application of an annular double mitre valve to pumps of every description, but specially adapted for the air-pumps of surface-condensing engines, or where a free passage with a small rise or lift, and where a quick action is desirable, as in the case of pumps worked at higher speeds; and further, in the the application of a peculiar ball, clack, or valve, or any number of them, for the same purposes. The double beat or mitre valve first named contains an annular space or ring between the inner diameter of the outer mitre, and the outer diameter of the inner mitre, of sufficient area to allow the water or other liquid a passage proportioned to the requirements of the pump. The upper portion or lid of the valve is formed of cast iron and wood, the wood part forming the mitres corresponding with those formed in the annular space in the valve seat. The lid of the valve is guided by a centre bolt of copper, or other material, with a collar or stop on the top end of it, by which the lift of the valve is regulated. The ball, clack, or valve consists of a circular seat of hard wood, fitted into a plate forming the bottom of the valve box, upon which a ball falls and closes the passage at each stroke of the pump. The balls may be made of cast iron or other material, either hollow or solid, and the lift regulated by suitable provision. *Patent completed.*

3152. J. Barclay. *Improvements in the construction and arrangement of rollers to be used in machinery for printing textile materials and fabrics, and in apparatus for drying and finishing the said materials or fabrics.* Dated November 24, 1862.

The first part of these improvements has reference to the construction of rollers to be used in the said printing machinery. These rollers are formed by preference of cast iron, or other suitable rigid non-yielding material. The periphery of each roller has formed in it a series of grooves of a dovetail figure, the greatest width being at the lower part of the groove. In these grooves are fitted lengths of wood, or the grooves may be filled with lead, or a metallic alloy, or with gutta percha, or other material suitable for affixing thereto the printing surfaces. In lieu of these grooves, the rollers may be made with slots or other apertures, so as to admit of slips of wood, or other suitable material, or of the engraved surfaces being affixed thereto in any convenient manner. These rollers are arranged to work in colour troughs, and to convey the colour on to the yarn or fabric passing round the printing cylinder. This portion of the machiney forms, however, no part of the present invention. The rollers are arranged in a segmental figure, extending round a portion of the periphery of the printing cylinder, and on the other side of the cylinder is fitted a roller covered with flannel, or other suitable material, which serves to brush the surface of the cylinder, and remove therefrom any colour which may adhere to it. This brushing roller is fitted below the surface of the cloth or yarn which is passing off from the upper part of the cylinder. If required, the roller may be caused to rotate in a trough of water, in order to cleanse more effectually the surface of the cylinder. In some cases, another and corresponding roller and trough may be fitted below, so that the cylinder is submitted to a second cleansing process before the imprinted yarn or cloth passes on to it, and each roller is fitted with a "doctor", or scraper to remove the moisture which the roller carries on to the cylinder. As the yarn or cloth is carried off from the cylinder, it passes through a drying apparatus, which constitutes the second part of this invention. This drying apparatus consists of a series of rollers arranged in pairs one above another. The yarn is carried up and down over and beneath these rollers, so as to present an extended surface to the action of the heat. *Patent abandoned.*

3153. J. H. Johnson. *Improvements in burnishing metal* *surfaces, and in the machinery or apparatus employed therein.* (A communication.) Dated November 24, 1862.

This invention relates to a mechanical and automatic burnishing of metal surfaces of all kinds, in lieu of the ordinary hand process hitherto adopted, and to a peculiar construction and arrangement of machinery or apparatus to be employed in burnishing metal surfaces. According to this invention, one or more articles to be burnished are properly adjusted upon suitable holders placed on a table, which is capable of lateral and transverse horizontal adjustment, by means of screws, racks, or otherwise. Immediately above the articles to be operated upon are arranged one or more series of burnishing tools, fitted with corresponding vertical spindles, which are capable of rotating individually by means of pulleys or otherwise, in a suitable frame contained in vertical guides at each end, so as to admit of the burnishers rising and falling and being lifted off or lowered down upon the articles to be burnished. In this frame there is also fitted a tracer point, which travels over a pattern surface corresponding exactly in size and shape with the articles to be operated upon. Each burnisher is pressed down by a helical or other spring upon the corresponding article beneath it. On imparting a rapid rotary motion to the several burnishers, and slowly traversing the tables containing the articles and the pattern surface to and fro in both directions, either simultaneously or separately, the burnishers may be made to work over the entire surface of such articles, and will rise and fall to accommodate themselves to any irregularity in the surface by the action of the tracer upon its pattern. *Patent abandoned.*

3154. E. Leigh. *Improvements in cotton gins.* Dated November 24, 1862.

In that kind of cotton gin called the "Macarthy" gin, the inventor places two, four, or more rollers, instead of one, as heretofore employed. These rollers, acting in pairs, are placed in a horizontal line about 14 in. apart in a frame, the length of which is determined by a number of rollers or power of gin required. In order to get the seed cotton delivered regularly to each pair of rollers, he places a hopper between them. The bottom of this hopper which receives the seed cotton is placed about 8 in. or 10 in. above the gin rollers, and is furnished with a pair of ragged feed rollers, which draw down the seed cotton and deliver it to be ginned, forming a vertical or drop feed, which can be regulated at pleasure. Instead of a single oscillating doctor, he makes one with double arms, having a blade at each end. These arms and blades, forming a compound lever, balance each other, and are actuated by one crank or eccentric motion; so that, when one knife is up, the other is down acting upon each gin roller alternately. These gin rollers are covered with leather having spiral grooves in the ordinary manner, excepting that he makes them of iron, which he covers with woollen cloth, india rubber, or other elastic substance under the leather. *Patent abandoned.*

3155. W. Tatham. *Improvements in machinery or apparatus for preparing and spinning cotton, wool, flax, and other fibrous materials.* Dated November 24, 1862.

In the machines known as openers and scutchers, the patentee applies a bar with a concave under surface to the top of the feed roller, between which and the bar the fibrous materials pass. The edge of the bar near the toothed cylinders or beaters, is nearly level with the centre of the feed roller, so as to hold the fibrous material more firmly between the bar and the feed roller than with the ordinary upper roller, and thereby enable the material to be more effectually operated upon than with two feed rollers. 2, In carding engines he applies a concave bar above the feed roller, similar to that before described for the opener and scutcher, and also makes the contact surface of the taker-in or cylinder and feed roller revolve in one and the same direction, in order to strip the fibrous material from the feed roller and concave bar in the same direction as that in which the feed roller revolves, which system of causing the taker-in or feed roller to revolve in the same direction, he applies to those carding engines in which the bar or plate is beneath the feed roller. 3, In doubling, drawing, or slubbing and roving frames, or in throstles, mules, and other spinning machines where drawing rollers are generally used for restraining and drawing or elongating the fibres of cotton or other fibrous material, he applies the following improvements—one part of which consists in drawing the fibrous material in each machine between two pairs of rollers only, which, when properly adjusted, are quite sufficient for restraining, drawing, or elongating the fibrous materials without the assistance of the usual additional drawing rollers; and the other part consists in employing an additional roller in connection with the aforesaid two pairs of drawing rollers, or using three rollers and bar. *Patent completed.*

3156. N. J. Amies. *An improved fabric to be employed as a substitute for elastic woven or braided webs, and improvements in the method of manufacturing the same.* Dated November 24, 1862.

This improvement consists in cementing or otherwise attaching a covering or coating of piece silk, or other woven fabric, to a surface, layer, or foundation of india rubber, or, if preferred, on each side of the india rubber, and so forming an economical substitute for the expensive elastic webbing at present employed. *Patent abandoned.*

3157. J. Moule. *An improved method of deodorizing mineral oils and hydro-carbons.* Dated November 25, 1862.

This invention consists in using deutoxide of azote or nitrous gas in any form, or nitrous acid may be used, for the purpose of deodorizing and destroying the peculiar and disagreeable odour found in various samples of petroleum and other rock oils, including paraffin oil, and also for removing and changing the odour of other liquids, the products of petroleum, coal, and other substances. *Patent completed.*

3158. T. and L. Robertshaw. *Improvements in the manufacture of textile fabrics, technically called "moreens."* Dated November 25, 1862.

This invention consists in the substitution of jute or hemp for worsted to form the weft in the manufacture of the fabrics technically called "moreens," that is to say, whereas hitherto fabrics known by this name have been manufactured with a worsted warp and worsted weft, under this invention they will be manufactured with a worsted warp and a weft composed either of jute or hemp. The mode of manufacturing such fabrics is in other respects the same as that now in use. *Patent abandoned.*

3159. A. L. Woolf. *A new or improved metallic alloy.* Dated November 25, 1862.

This invention consists of a new or improved metallic alloy, which is highly malleable and ductile, and of a colour scarcely to be distinguished from that of gold. The said alloy is less liable to oxidize or tarnish than other base metals or alloys, and is suited for the manufacture of jewellery; it may also be applied to other purposes. The said alloy is composed of from 90 to 100 parts weight of copper, from 5 to 7½ parts by weight of aluminium, and 2½ parts by weight of gold. In making the said alloy, it is only necessary to melt together in a crucible the respective quantities of the several metals of which it is composed, when on fusion the metals immediately enter into alloy. *Patent completed.*

3160. E. Wadsworth. *Improvements in machinery used in the manufacture of certain descriptions of braid.* Dated November 25, 1862.

This improvement in braiding machinery is applicable to those machines in which gut, india rubber, or other thick threads are interwoven with or covered by the braiding thread, and consists in effecting the stoppage of the braiding machinery by so arranging or connecting a lever or weight with thick or foundation threads that, in the event of their becoming detached or broken, or not forming one contiuous thread from the supply spools or bobbins to the manufactured braid, the said lever or weight shall come into contact with any suitable arrangement of mechanism, as may be designed, to stop the machinery, thus making the disunion of the thread stop the machine by self-acting means. *Patent completed.*

3161. J. S. Jarvis and J. H. Brierley. *Ladies and gentlemen's leather collars.* Dated November 25, 1862.

In carrying out this invention, the inventors make use of and cut or form white or coloured enamelled or any other kind of leather into such shape or configuration as to be suitable for ladies or gentlemen's collars of any kind or description. That portion overlaying the ladies' dress, and that portion overlaying the gentlemen's tie, is single or unlined leather, and ornamented as required. The inner or other part of ladies or gentlemen's collars is double or lined leather, with calico inserted between the two leathers at the points where the button-holes are cut, if the leather be of such a nature as to require the same. *Patent abandoned*

3162. W. B. Caulfield. *Porous stems for tobacco pipes.* Dated November 25, 1862.

According to this invention, a tube of any convenient diameter is composed of the pulp of rags, or any other fibrous material, or from felt, or from paper rolled up together, more particularly of such paper as is commonly known as "blotting paper." This tube is to be used inside of the stem of a tobacco pipe, or as a stem by itself; it will absorb the essential oil and juices arising from the combustion of the tobacco, and will prevent the smoker from suffering any hurt or inconvenience therefrom, until it becomes saturated, when it can be instantly replaced by another fresh and clear stem. *Patent abandoned.*

3163. G. Henderson. *Improvements in steam-engines.* (A communication.) Dated November 25, 1862.

This invention consists in a peculiar combination of parts, by which some of the steam generated may be used in two or more cylinders in succession, without that back pressure on the piston in the first cylinder which has heretofore resulted when using steam expansively in two or more steam cylinders. The combination is such, that each of the steam cylinders is capable of being put in communication with a condenser, or with the outer atmosphere on one side of the piston when steam is being admitted into the cylinder on the other side of the piston. To accomplish this, the steam is expanded from the first steam cylinder into a vessel which the patentee calls an "accumulator," from which the steam is supplied to another steam cylinder, the communication between the first steam cylinder and the accumulator being closed by a suitable valve when steam from the accumulator is being supplied to another steam cylinder. The working of the machinery is such, that on opening the exhaust from the first steam cylinder, the steam expands into the accumulator of an additional steam cylinder, and then to the condenser, if only one additional cylinder be employed; but if more than one additional steam cylinder be used, then the exhaust, having been opened to the first accumulator, is cut off therefrom, and the exhaust steam is then allowed to expand into the accumulator of a second additional steam cylinder before the exhaust of the first cylinder is allowed to pass to the condenser. It is preferred to employ two accumulators and two additional steam cylinders. *Patent completed.*

3164. G. Ransome. *Improvements in apparatus for preparing clay for brick-making and other purposes.* Dated November 25, 1862.

This invention consists in the following improved sieves, and the mode of agitating them:—The patentee takes an ordinary sieve of the rectangular form, about 4 ft. 6 in., or 5 ft. in length, and about 2 ft. 6 in. in width, and suspends it horizontally in a suitable framework by four leather straps, one at each corner, from beams above it, one end, however, being about 3 in. higher than the other. He then fixes into the bottom of it, about 6 in. apart, several slack thin iron chains of ⅛-in. iron, the ends of which are fastened to the opposite ends of the longer length of the sieve. These chains are to be about 2 in. in length longer than the sieve, so that, when the sieve is in motion, the slack parts shake about among the clay under operation without coming in actual contact with each other. To the sieve so suspended and constructed he attaches a crank shaft, descending perpendicularly upon it from above, the crank being at the lower end, and fitted with a socket inserted into a cross bar extending from side to side over the centre of, and firmly secured to, the sieve. He uses a crank, the arm of which, when in motion, describes a circle of 8 in. in diameter. The shaft is made to revolve by any of the ordinary methods in general use, and when in motion, and charged either by hand or from a shoot above, the sieve is agitated in a circular horizontal manner, whereby the clay is sifted or screened, the fine being collected for use, and the rough, or lumpy parts, passing away as in ordinary methods. *Patent completed.*

3165. A. V. Newton. *Improvements in sewing machines.* (A communication.) Dated November 25, 1862.

This invention relates more especially to those machines which are employed in uniting or stitching together the edges of a fabric, and has for its object the production of a machine which shall be capable of working a button-hole or other similar article in a practically successful manner by automatic means. The extreme length of the specification precludes a detailed description of the invention here. *Patent completed.*

3166. W. Longley. *Improvements in machinery for making bricks.* Dated November 25, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3167. T. M. Elton. *Improvements in the manufacture of soap and in the machinery employed therein.* Dated November 25, 1862.

This invention consists of an improved manufacture of that class of soap known as mottled or marbled and fancy soap, and also in the machinery whereby such improved soaps are made. The patentee constructs the machinery as follows:—He forms a frame of an oblong or square form, supported on wheels or otherwise, at one end of which a hopper is fixed at the top of the frame; the exit passage at the bottom of the hopper is regulated by means of a vertical slide the entire width of the passage, below which a drum or cylinder is fixed on a shaft and set in bearings in the frame. This drum extends across the machine, and is of the full internal width of the frame, and another similar drum is placed at the other end of the frame. These drums are enclosed by an endless band or belt of leather, felt, or printer's flannel, or other suitable material (the patentee finds in practice that canvas coated with india rubber is very well adapted to the purpose), the surface of which should lie in an oblique direction by the requisite position of the machine. This endless band is supported between the drums by means of a flat board or metal plate, so as to preserve a perfect level, and the drum at the end of the machine furthest from the hopper is set in moveable bearings or blocks, so as to enable the band to be always kept tight thereon: the bottom of the hopper reaches the surface of the band. At the end of the machine last referred to, and beyond the drum, a vessel is placed which contains a coloured soap or a colouring liquid or pigment in solution. This soap or liquid is kept in a heated state by means of a small furnace. Above this vessel a cylindrical drum is set in bearings in the frame. Attached by hinges to this drum is a series of bars of metal, running lengthwise of the drum at regulated distances apart; these bars carry rows of metal scrapers having their ends turned up at an angle, so as to form flat-headed scoops, and these scoops or scrapers pass through the coloured soap or liquid, and carry it round with them. This drum receives the rotary motion, by means of a band and grooved pulley, from the first drum which works the endless band. The driving wheel actuates a cogged wheel gearing into another toothed wheel on the shaft of the first drum, whereby motion is communicated to the machine. *Patent completed.*

3168. T. Fletcher. *Improvements in the construction of rollers, cans, spools, and bobbins, and in the machinery employed therein.* Dated November 26, 1862.

This invention is not described apart from the drawings. *Patent completed.*

3169. J. Aspell and E. Booth. *Certain improvements in looms for weaving.* Dated November 26, 1862.

This invention relates to that portion of the power loom known as the letting off motion, and is designed for the purpose of regulating the tension and the "letting off" or delivery of the yarn. The improvement consists in applying or employing the movement or vibration of the woven cloth (caused by the "shedding" and "beating up" motion) to the letting off or delivery of the warp, by any mechanical arrangement interposed between the woven cloth and the warp beam. *Patent abandoned.*

3170. J. Steinthal. *An improved moulder's blacking.* Dated November 26, 1862.

Instead of the ground charcoal hitherto used by moulders in the process of making metal castings, the patentee uses the following materials in about the following proportions:—Wood charcoal, 0·45; anthracite, commonly called shale or slate, 0·45; animal carbon, 0·10; with a small quantity of prussiate of potash. The said materials are to be well mixed together and reduced to a fine powder by grinding, pounding, or other suitable means. He subjects the anthracite used in the manufacture of this improved blacking to the process of cokeing in a stove or kiln, by which the paraffin, oily, and sulphurous substances and gases are extracted. The anthracite and animal carbon being non-conductors, withstand the sulphuric gases of the fluid metal, so that the coat of blacking between the mould and the metal remains intact, the fluid metal forming a perfect casting, thus preventing blisters and blemishes on the castings caused by the affinity of the the sulphuric gases to the silicate contained in the sand. *Patent completed.*

3171. F. Palling. *An improved fountain penholder.* Dated November 26, 1862.

This invention consists in so constructing a fountain penholder that, when a writing nib or pen is adapted thereto, the said nib, when pressed upon the surface of the material to be written upon, shall cause pressure upon an elastic tube containing the writing fluid, and cause the said fluid to be discharged therefrom intermittently. *Patent completed.*

3172. J. F. Foveaux. *Improvements in apparatus for pulverizing or dividing liquids into spray.* (A communication.) Dated November 26, 1862.

This apparatus consist of a syringe barrel with a contracted outlet leading into, by preference, a flexible metal tube (but any other tube may be used), on the outer end of which a nozzle is screwed or otherwise fitted. The aperture in the nozzle is more or less contracted according to the distance to which the spray is to be projected, and to the degree of fineness required. Inside the syringe barrel a piston is fitted and is worked by a screw piston rod passing through a threaded nut in the cover of the barrel. The apparatus is applicable to medical, horticultural, and other purposes where liquid in minute spray or in a state of dew is desired. *Patent completed.*

3173. W. Austin. *An improved material for the manufacture of cartridge cases, applicable also for tubing and other useful purposes.* Dated November 26, 1862.

This material is to be made as follows:—The inventor proposes to take a woven fabric of cotton or flax, or other fibrous substance, and coat the same with any suitable adhesive solution, after which it is to be covered with a layer of paper on one or both sides, and then subjected to pressure, either by rolling flat, or other pressure hot or cold. *Patent abandoned.*

3174. J. R. Danks, and P. B. and R. P. Walker. *Improvements in machinery or apparatus for making boot and shoe heel and toe tips, clog irons, and other similar articles.* Dated November 26, 1862.

This invention consists in constructing machines for the manufacture of boot and shoe tips, clog irons, and other similar articles, in such a manner that the operations of bending the pieces of metal intended to be formed into tips or other articles, and afterwards piercing the tips or other articles with the necessary holes for the reception of the fastenings, are performed automatically in one machine, in place of each operation being performed separately as at present. *Patent completed.*

3175. A. V. Newton. *An improved mode of preparing oxide of zinc as a pigment.* (A communication.) Dated November 26, 1862.

The object of this invention is to enable the white oxide of zinc to be manufactured into paint having a desirable degree of body, and to this end the invention consists in subjecting it in its dry state to the combined action of friction and pressure, by which means its bulk is greatly reduced, and it is enabled to be ground with a reduced quantity of oil. *Patent completed.*

3176. J. Halford. *Improvements in the preparation and treatment of a mineral substance to be used in, and in the manufacture of, iron and steel in the processes of casting and moulding metals, and in the manufacture of paint and such like articles.* Dated November 27, 1862.

We cannot here devote space to the details of this invention. *Patent completed.*

3177. A. A. Pheloux and P. A. Paumier. *A new atmospheric sailing propeller.* Dated November 27, 1862.

This new atmospheric sailing propeller is composed of a reservoir with double casing, into which reservoir air is introduced by means of suction and force pumps worked by steam. The air being brought into the reservoir is compressed several atmospheres, according to requirement, and escapes by blow-pipes placed tangentially to the side of the ship, at an inclination varying with the draught thereof and the speed required. There are two blow-pipes on each side of the ship turned towards the prow, and two towards the poop. The impulsion is given by the air, which, escaping from the reservoir by the blow-pipes, comes forcibly against the mass of water. Two blow-pipes, uniting into one near the reservoir, are placed on each side the rudder beneath the water-line, and may, in case of accident to the wheel or tiller, serve conjointly with the side pipes to work the ship, obviating the necessity of replacing the rudder, which might, in fact, be entirely superseded by this system. The waste steam circulates within the double casing of the reservoir, and heating the air gives it a greater expansive power. *Patent abandoned.*

3178. F. W. Hartley. *Improved means of obtaining certain products resulting from the manufacture and purification of coal gas.* (A communication.) Dated November 27, 1862.

This invention has for its object the adoption and emploment of certain improved means (which we cannot here describe in detail) for obtaining sulphate of ammonia from the oxide of iron used in purifying gas, by which a larger quantity of sulphate of ammonia is produced and the cost of such production is lessened. *Patent abandoned.*

3179. T. Keyworth. *Improvements in motive power machinery.* Dated November 27, 1862.

This invention consists of a series of jointed levers, all of the same length, excepting the last lever, which may be either longer or shorter than the other levers, and may be either jointed or not. The fulcrum of each jointed lever aforesaid should be so placed as to give a lever power of three to one. These levers the patentee proposes to arrange and dispose side by side, as follows:—He places the second lever with its short arm opposite to the long arm of the first lever, and the third lever he arranges the same as the first lever, and in this manner he arranges the several levers with respect to each other. In connection with the long arm of each jointed lever aforesaid, he employs a jointed metal belt, passing around two rollers placed one above the other, and to this belt he connects the long arm of the jointed lever aforesaid. The rollers aforesaid are each mounted on one end of a spindle working in suitable bearings, and on the other end of the said spindle a pinion is fixed, the said pinion taking into the teeth of a sun-and-planet wheel, the axis whereof is midway between the axes of the two rollers aforesaid. The outer rim of the aforesaid sun-and-planet wheel has bevelled teeth formed thereon, which gear into a bevelled pinion fixed on a crank spindle revolving crosswise of the axis of the aforesaid sun-and-planet wheel. The two cranks of the aforesaid cranked spindle are formed at right angles, or nearly so, to each other, and are connected each by a horizontal rod to two other similar cranks on a spindle placed parallel to the first-named cranked spindle, the use of the said rods being to pass the mill-point of said cranks. When more than one jointed lever aforesaid is employed, the patentee employs a sun-and-planet wheel and jointed belt before described to each and every jointed lever employed for imparting motion thereto. The short end of each jointed lever is connected by a vertical rod to another cranked spindle or shaft for imparting rotary motion thereto. He also proposes to affix a fly-wheel on the end of the said spindle or shaft. The motive power obtained by the above improved machinery may be transmitted in any convenient manner, according to the purpose for which it is required. *Patent completed.*

3180. W. T. Rowlett. *Improvements in machinery used in producing knit or looped fabrics.* Dated November 27, 1862.

For the purposes of this invention, it is preferred that a series of independent sinkers should be employed, suspended on a wire or axis at their upper ends. These sinkers are kept correctly in position by working between the teeth of a comb. The row of needles is mounted or fixed on a bar which receives a rising and falling motion, the needles being fixed in an upright position, but the needle bar or the needle thereon may be arranged to turn down into a horizontal position in order to place work on the needles. The sinkers are constantly pressed back in a direction from the needles by springs. The needles work between teeth on a stationary bar, which acts as a knocking-over bar to knock over the work as the needle bar descends; but, if preferred, the needle bar may be stationary and the knocking-over bar be made to rise and fall. In order to actuate the sinkers in succession, a barrel or cylinder is used, on which is formed a cam or inclined or spiral projection, which, acting on the backs of the sinkers, presses them forward in succession, so as to sink the thread or yarn between the needles and retain the sinkers in that position for a time. On the axis of the barrel or cylinder are cams to act on suitable levers or intervening instruments to cause the needle bar to rise and fall, or, in place thereof, the knocking-over bar. The thread carrier is of the ordinary construction, and is caused to move to and fro across the row of needles by cams on the axis of the barrel, or otherwise. In working a course with this machine, the thread carrier lays a thread across the needles, and the sinkers, by the action of the spiral or cam surface thereon, acting on the backs of the sinkers, are caused in succession to sink the thread between the needles, which are preferred to have beards or tongues which move on axes. The descent of the needle bar will then cause the needles to descend, whilst the work is supported by the knocking-over bar, and beyond the open moveable beards of the needles, by which the work, acting on the beards, will cause such beards to shut and inclose the new loops within the eyes of the needles, and the further descent of the needle bar will cause the work to be knocked over, or the working of the sinkers employed may be so arranged as themselves to knock over the work. The needle bar will then be caused to rise to its highest position, when the thread carrier will be again moved across the row of needles, and will lay its thread across them, whilst the spiral cam or surface of the barrel or cylinder will cause the sinkers to sink the thread between the needles, and so on continually. In order to vary the length of loops, the bearings of the axis of the barrel or cylinder are arranged to admit of being adjusted in a direction to or from the front of the machine; or in place thereof, the needle bar may be arranged to be adjusted to or from the barrel or cylinder. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated March 11, 1863.

669. A. Barclay, Kilmarnock, engineer. Improvements in traction engines and in apparatus for indicating the pressure of steam.

Dated April 21, 1863.

997. W. Ryan, 17, Fishamble-street, Dublin, engineer and machinist, and W. Daniel, 55, Mary-street, ironmonger and gas engineer. Improvements in apparatus for transmitting, equalizing, and registering human power.

Dated April 28, 1863.

1062. G. Hall and J. Wells, Worcester. A new explosive compound, applicable for all the purposes for which gunpowder is or may be used.

Dated May 8, 1863.

1157. E. C. Boët, Lille, France. Improvements in tanning hides and skins. (A communication.)

Dated May 11, 1863.

1180. C. L. V. Tenac, Tredegar, Monmouthshire, civil engineer. A new wrought-iron railway sleeper. (A communication.)

1181. C. L. V. Tenac, Tredegar, Monmouthshire, civil engineer. Armour plates of hammered or rolled wrought iron, the whole of the rivets being protected against the direct blows from the cannon shots.

Dated May 21, 1862.

1273. F. P. Warren, East Court, Cosham, Commander in the Royal Navy. Improvements in attaching copper or other sheathing to iron vessels.

1281. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in breech-loading ordnance, breech-loading and other small arms. (A communication.)

Dated May 23, 1863.

1292. J. Sturgeon, Leeds, York, consulting engineer. Improvements in steam hammers.

Dated May 25, 1863.

1318. M. J. Roberts, Pendarren, near Crickhowell, esquire. Improvements in means of, and apparatus for, preparing, spinning, twisting, and doubling wool, cotton, and other fibrous substances, and in lubricating the spindles and other parts of machinery used in these and other operations.

1319. J. W. Burton, S. G. Rhodes, S. F. Seanor, Leeds, and W. Scruton, Liverpool. An improved machine or apparatus for getting coal or other minerals.

Dated June 1, 1863.

1364. J. Chalmers, 8, Knight's-place, Vauxhall. Improvements in armour for forts and floating batteries.

1366. F. W. Smith, 180, Upper Thames-street, merchant. Improved apparatus for conveying of goods either in bulk or otherwise, whether to or from the warehouse or vessel having an inclined vertical or horizontal movement, to be worked either by pressure of air or by vacuum and atmospheric pressure.

Dated June 2, 1863.

1380. E. H. Létang, 12, Rue du Chemin de Reuilly, Paris. An improved ruling and printing machine to be used either combined or separately.

Dated June 3, 1863.

1384. J. Travis, Luzley Brook, Lancaster, gentleman. An improved method of preventing the incrustation of earthy matter in steam boilers, steam generators, and fuel economizers.

1388. W. Lee, 23, Sumner-place, Onslow-square, and J. G. Winter, 73, Great Suffolk-street. Improvements in steam fire-engines. (A communication.)

Dated June 5, 1863.

1400. R. W. Sievier, Guildford-street, Russell-square. Improvements in jacquard machines. (A communication.)

1402. R. A. Brooman, 166, Fleet-street, patent agent. Improvements in treating liquorice root to obtain liquid and solid extracts therefrom. (A communication.)

1406. J. H. Johnson, 47, Lincoln's-inn-fields, gentleman. Improvements in smoothing irons. (A communication.)

Dated June 8, 1863.

1412. N. Walton, Aldenham-street, Saint Pancras. Improvements in apparatus for drying and airing clothes.

1416. W. Clark, 53, Chancery-lane, engineer. A new and useful device for turning cross head wrists or pins, or for turning any cylindrical part of machinery which is secured between two arms. (A communication.)

1420. J. G. Jones, Cumming-street, Pentonville, and R. Ridley, Leeds. Improvements in machinery and apparatus for working coal and other mines.

1422. R. C. Furley, Edinburgh. Improvements in the preparation of castor and other oils for medicinal use.

1424. W. E. Newton, 66, Chancery-lane, civil engineer. An improvement in needles. (A communication.)

1426. J. Petrie, Rochdale, machine maker. Improvements in machinery or apparatus for washing wool and other fibrous materials.

Dated June 9, 1863.

1428. G. Hills, Blackheath, chemist. Improvements in obtaining certain products from hops.

1430. E. Barlow, Bolton, machine maker, J. Newhouse, Farnworth, near Bolton, manager, F. Hamilton, foreman, and W. Hope, carder, Bolton. Certain improvements in machinery for grinding card teeth.

1432. J. Edwards, 29, Basinghall-street. Improvements in railway chairs and sleepers.

1434. J. Murray, Whitehall-place, solicitor. Improvements in clips or holders for inserting and fixing photographic pictures in albums.

1436. M. Siegrist, Ewell. Improvements in the construction of fountains.

1438. H. F. McKillop, captain Royal Navy, Belvedere. Improvements in compositions for coating or covering ships bottoms.

Dated June 10, 1863.

1440. W. Madders, Manchester, embroiderer by machinery. A new and improved ornamental fabric.

1442. W. Roberts, Millwall, Poplar, engineer. Improvements in steam boilers.

1446. T. Evans, Manchester, and E. Hughes, letter press printers. Improvements in apparatus for applying one or more colours of ink to type in letter press printing by hand.

Dated June 11, 1863.

1450. T. M. Harrison, Birmingham, manufacturer. An improvement or improvements in the manufacture of metallic casks.

1452. J. F. Kain, Fleur-de-lis-street, Norton Folgate, ivory worker. Improvements in umbrellas, parasols, sunshades, walking sticks and whips, and in brooches and othe ornaments.

1456. J. Webster, Birmingham, engineer. Improvements n indurating iron, and in protecting iron and steel from oxidation.

1460. E. O. Hallett, Weymouth and Melcombe Regis, Dorset, cabinet maker. Improvements in constructing the sides of ships, batteries, and fortifications, and in applying armour plates thereto.

1462. J. Johnson, Peterborough, engineer, and W. Braithwaite, foreman. Improvements in reversing levers for locomotive engines and others.

LIST OF SEALED PATENTS.

Sealed June 19, 1863.

3417. R. A. Brooman.
3437. G. Haseltine.
3435. A. P. Tronchon.
3138. W. Henderson.
3444. J. Taylor.
3445. J. and W. Lord.
3454. E. T. Loseby.
3470. J. Johnston.
20. J. E. Dowson.
276. F. G. Stuber.

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, June 23, 1863.

358. J. Goucher. Regulating the admission of air into the furnaces of steam boilers.

362. T. Hill. Protection of markers at rifle butts.

365. M. Cartwright. Combining plastic substances with metals.

369. H. Donald. Machinery for shearing, punching, and riveting metals.

381. A. Morton. Lawn mowing machines.

385. G. H. Birkbeck. Separating or extracting silver or other metals from lead. (A communication.)

386. S. M. C. Innes. Pianofortes.

388. J. Jones. Manufacture of lead, tin, and other metals.

393. G. Wrigley and S. Morris. Spinning and doubling.

396. S. Whitaker. Railway signals.

401. J. S. Gisborne and W. Simpson. Rendering ships' and other compasses insensible to local attraction.

402. H. Dembinski. Motive apparatus and processes proper for giving to it a continuous motion and unlimited strength.

410. J. and H. Higgins. Carding engines.

413. J. H. Johnson. Wrought-iron casements. (A communication.)

418. J. B. Watts. Matchets and swords.

420. R. A. Brooman. Cover or protection for steel and other metal springs, ribbons, and hoops. (A communication.)

432. J. Durrant. Chimney tops.

452. T. Markland and J. C. Dickinson. Warping or beaming yarns or threads.

459. H. B. Barlow. Weaving. (A communication.)

462. C. Billingsley. Saddlery, harness, driving straps, and similar articles.

473. H. Kilshaw and T. Elce. Preparing and doubling fibrous substances.

481. J. Brown. Armour plates for ships and other structures. (A communication.)

491. R. Martindale. Lamps and burners.

498. W. Whitehead, H. Whitehead, and H. Barber. Manufacture and securing of cutlery, handles, and machinery employed therein.

499. J. Clay. Manufacture of saddles.

544. W. Clark. Manufacture of buttons. (A communication.)

564. W. Hadfield. Steam-boilers.

586. W. Clark. Photographic impressions. (A communication.)

646. R. Mushet. Manufacture or treatment of pig or cast iron.

656. J. R. Gorst. Carriages.

665. W. R. Mulley. Sheathing iron ships, caissons, and other like structures.

691. W. West. Valves.

714. W. H. Emett. Facilitating and combining the art of writing with engraving together on stone, applicable to maps, plans, specifications, and other lithography, which improvements are also available for retransfers to zinc or stone or printing from original.

749. G. Coles, J. A. Jaques, and J. A. Fanshawe. Washing and wringing clothes or fabrics.

788. R. Mushet. Pneumatic process.

818. R. Mushet. Improvements in moulds.

848. D. S. Sutherland. Protecting vessels of war.

1080. W. Rodger. Anchors.

1252. F. Fenton. Treatment of certain vegetable fibres.

1264. P. Addington. Manufacture of varnishes.

1309. H. A. Bonneville. Construction of carriages. (A communication.)

1402. R. A. Brooman. Treating liquorice root to obtain liquid and solid extracts therefrom. (A communication.)

The full titles of the patents in the above lists can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

Sealed June 23, 1863.

3459. J. Petrie.
3460. M. Ker.
3461. J. G. Taylor.
3465. F. Tolhausen.
3476. W. Mould.
3482. W. B. Adams.
10. W. Robinson.
26. S. White.
28. C. B. Clough.
60. G. A. Huddart.
73. W. H. Tucker.
94. E. Stevens.
111. L. Lescuyer.
120. G. A. Biddell.
122. J. Lawson.
125. T. Wilkinson.
153. J. Combe.
167. J. Mosheimer.
213. C. Turner.
227. J. B. Fell.
246. W. E. Gedge.
325. W. Betts.
331. B. F. Bates.
930. R. Newton.
994. W. E. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1466. M. and M. Myers and W. Hill
1468. W. Dray and R. Gardiner.
1470. E. Deane and W. D. Marsh.
1475. E. Stone.
1476. T. Kershaw.
1478. H. Nicholson.
1492. G. Hinton.
1499. R. Bodmer.
1500. F. Preston.
1507. W. Baker.
1516. H. Palmer and H. S. Swift.
1521. W. Macfarlane.
1527. J. Ramsbottom.
1532. H. Jones.
1543. W. Routledge.
1546. W. Hooper.
1837. J. Hamilton.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1437. M. A. Muir, and J. McIlwham.
1441. G. Tillet.
1453. J. Bullough.
1471. G. Riley.

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending June 20, 1863.

No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.		No.	Pr.	
	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
3027	1	4	3063	0	8	3073	0	4	3083	0	8	3093	0	6	3104	0	10
3053	0	8	3064	0	4	3074	0	4	3084	0	10	3094	1	4	3105	0	10
3054	0	4	3065	0	8	3075	0	6	3085	0	4	3096	1	0	3106	0	4
3056	0	4	3066	0	10	3076	0	4	3086	0	4	3097	0	8	3107	0	4
3057	0	8	3067	0	4	3077	0	10	3087	0	8	3098	0	8	3108	0	6
3058	0	4	3068	0	8	3078	0	4	3088	0	4	3099	0	10	3109	0	8
3059	0	8	3069	0	4	3079	0	4	3089	0	8	3100	2	8	3110	0	8
3060	0	10	3070	0	4	3080	0	4	3090	0	4	3101	0	6	3111	1	10
3061	0	8	3071	0	4	3081	0	10	3091	0	6	3102	0	4	3112	0	10
3062	0	4	3072	0	6	3082	0	10	3092	0	4	3103	0	6	3113	1	4

Note.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennet Woodcroft, Great Seal Patent Office, 25, Southampton-bdgs, Chancery-ane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Metals.

		£	s.	d.		£	s.	d.	p ct.
Iron:—									
Welsh Bars, in London	per ton	6	5	0	to	6	10	0	2½
Nail Rods	do	7	0	0		7	5	0	
Hoops	do	8	5	0		8	10	0	
Sheets, single	do	9	10	0		9	15	0	
Staffordshire Bars	do	7	10	0		8	0	0	
Bars, in Wales	do	5	10	0		5	17	6	
Rails	do	5	12	6		6	0	0	nett
Foundry Pigs, at Glasg, No 1	do	2	10	6		2	16	0	
Swedish Bars	do	11	10	0		12	0	0	2½
Steel:—									
Swedish Keg, hammered	do	16	0	0		0	0	0	
Swedish Faggot	do	17	0	0		18	0	0	
Copper:—									
Sheet & Sheathing, & Bolts	do	96	0	0		0	0	0	3
Hammered Bottoms	do	105	0	0		0	0	0	
Flat Bottoms, not Hamrd	do	101	0	0		0	0	0	
Tough Cake and Ingot	do	89	0	0		0	0	0	
Tile Copper	do	89	0	0		0	0	0	
Best Selected	do	92	0	0		0	0	0	
Compositn. Sheathing Nails	per lb.	0	0	10		0	0	0	
Yel. Metal Sheathing & Rods	do	0	0	8½		0	0	8½	
Fine Foreign	per ton	94	0	0		95	0	0	
Tin:—									
English Block	per cwt.	6	2	0		0	0	0	2½
do Bar	do	6	3	0		0	0	0	
do Refined	do	6	8	0		0	0	0	
Banca	do	6	14	0		6	15	0	nett
Straits	do	6	7	0		6	10	0	
Tin Plates:—									
Best Charcoal, I.C.	per box	1	8	6		1	9	6	
Second Quality	do	1	6	6		1	7	6	
Coke	do	1	2	6		1	4	0	
Lead:—									
Pig, English	per ton	20	10	0		22	15	0	2½
,, Spanish Soft	do	19	17	6		19	10	0	
Shot, Patent	do	23	10	0		0	0	0	
Sheet	do	21	10	0		0	0	0	
White	do	27	0	0		27	10	0	
Spelter:—									
On the spot	do	17	10	0		17	12	6	nett
Zinc:—									
English Sheet	do	23	5	0		0	0	0	2½
Quicksilver	per btl.	7	0	0		0	0	0	3
Regulus of Antimony:—									
French star	per ton	42	0	0		0	0	0	2½

Timber, duty 1s. per load, drawback 1s.

		£	s.	£	s.
Teak	load	£12	0	£13	0
Quebec, red pine		3	10	4	10
,, yellow pine		3	10	4	10
St. John, N.B., yellow		0	0	0	0
Quebec oak, white		5	10	6	10
,, birch		3	10	4	10
,, elm		3	10	5	0
Dantzic oak		3	10	6	10
,, fir		2	10	3	10
Memel fir		3	5	3	10
Riga		3	0	3	5
Swedish		2	10	2	15
Masts, Quebec red pine		5	0	6	0
,, yellow pine		5	0	6	0
Lathwood, Dantzic, fm		5	10	6	10
,, St. Petersburg		8	0	8	10
Deals, perC., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.					
Quebec, white spruce		15	10	18	10
St. John, white spruce		14	0	15	10
Yellow pine, per reduced C.					
Canada, 1st qual.		17	0	18	0
,, 2nd do.		11	0	12	0

		£	s.	£	s.
Archangel, yellow		£13	0	£13	10
St. Petersburgh, yel.		11	10	12	0
Finlan		9	0	10	0
Memel		10	0	15	0
Gothenburg, yellow		10	0	11	0
,, white.		9	0	9	10
Gefle, yellow		10	10	11	10
Soderhamn		9	10	10	10
Christiania, per C., 12ft. by 3 by 9 in.					
Christiania, yellow		21	0	23	0
DeckPlank, Dantzic, per 40 ft. 3 in.		0	14	1	4
Pumice Stone	pr ton	5	10	9	0
Oils, &c.					
Seal, pale	per tun	48	0	0	0
Sperm body		81	0	82	0
Cod		51	0	52	0
Whale, Sth Sea, pale		46	0	0	0
Olive, Gallipoli		59	0	60	0
Cocoanut, Cochin		47	0	0	0
Palm, fine		36	0	36	10
Linseed		45	0	0	0
Rapeseed Eng. pale		49	0	0	0
Cottonseed		33	10	41	10

FRENCH & SMITH, Sworn Brokers,
4, Brabant-court, Philpot-lane, E.C.; and at
4, Rumford-place, Liverpool.

THE MECHANICS' MAGAZINE.

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The *Standard*, November 15, speaking of Benson's watches in the Exhibition, says:—"It has evidently been Mr. Benson's object to render them rivals in point of beauty of decoration to the elegant Swiss knicknacks, and at the same time to preserve the characteristics of an English watch—strength, durability, and accuracy. In point of decoration his watches are certainly unsurpassed." Chronometer, duplex, lever, horizontal, repeaters, centre seconds, keyless, split seconds, and every description of watch, adapted to all climates. Benson's Illustrated Pamphlet on Watches (free by post for two stamps) contains a short history of clock and watch making, with descriptions and prices; it acts as a guide in the purchase of a watch, and enables those who live in Scotland, Ireland, Wales, the Colonies, India, or any part of the world, to select a watch, and have it sent free and safe by post.—J. W. Benson, Prize Medallist, 33 and 34, Ludgate-hill, London. Established 1749.

MESSRS.
ROBERTSON, BROOMAN, AND CO.,
Civil Engineers
AND PATENT AGENTS
(Established 1823),
166, FLEET STREET, LONDON.
UNDERTAKE TO OBTAIN PATENTS FOR INVENTIONS.
PROVISIONAL PROTECTIONS
APPLIED FOR.
Specifications Drawn and Revised.
Disclaimers and Memorandums of Alteration
Prepared and Filed.
Oppositions Conducted.
CONFIRMATIONS & PROLONGATIONS
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